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THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The semi-annual meeting and excursion of the members of the Association, with their ladies and friends, will occur on the 13th and 14th days of August, 1879. Those intending to be present are requested to meet at the Narragansett Hotel, Providence, R. I., on the 13th day of August next, at 10 o'clock, A.M. It is proposed to visit, in the forenoon of the first day, the works of the Providence Gas Company and other places of interest in the city, after which the party will take a steamer for Rocky Point, where they will remain till next day. In the morning of the next day, the excursion will be continued by steamer to Newport, where a ride will be taken over a very delightful route, and many points of interest visited, after which an opportunity will be given to those who desire to do so, to return home by the evening trains or steamers.

The committee in their arrangements for the occasion will endeavor to make the expense to each person participating, as light as possible; most, if not all, of the expense for steamboat fares, and carriage hire will be paid by the Association.

As it is highly important for the committee to be informed at an early day, as to the probable number to be provided with transportation, lodging, meals, etc., members will confer a favor upon them by notifying the Secretary, at once, whether they will attend said meeting; and, if so, how many friends, and particularly, how many ladies (if any) will accompany them.

Boston, July 15th, 1879. GEO. B. NEAL, *Secretary*.

LIGHTING BY ELECTRICITY.

We would call the special attention of our readers to the paper by Mr. Sugg, presented to the British Association of Gas Managers at their recent meeting at Newcastle, which will be found in this issue.

There is probably no one who has more thoroughly investigated this subject in the relations it bears towards the gas interest, no one who has devoted more time to the careful testing and comparison of the two methods of lighting, and, above all, no one more fitted from education, ability, practical experience and zeal, to do this work *impartially* than Mr. Sugg. One might be led to think, from a cursory reading of the paper, that he was not impartial; but from personal knowledge of the man, and from being associated with him in a portion of his earlier investigations, we are able to say that the work was commenced with the fullest determination to give to the electric light every credit justly its due, in other words, to find out what was in it as a means of illumination. This course has doubtless been followed throughout, and if the testimony he gives, as the result of months of labor and study, seems to bear very strongly on the side of gas, it is because that is the truth, as shown by facts derived from many impartial experiments—and, it may be added, because the capabilities of gas are perhaps better understood and more fully developed by Mr. Sugg than almost any single investigator who has treated the subject. One thing is evident, the electric light has been of great advantage in promoting and developing those heretofore unused, and, as it were, latent light-giving powers of coal gas, which the improved and greatly enlarged burners of to-day render useful and economical wherever large volumes of artificial light are wanted.

THE GAS WAR IN NEW YORK.

The reduction in price, which we announced in the last issue, on the part of the Manhattan, Mutual, Municipal, and New York Companies has since been followed by a similar circular from the Metropolitan Company, which we give in another column. This latter circular starts at $1.90 per thousand, for bills of 5,000 feet a month, and descends to $1 per thousand for bills of 150,000 feet a month. The "shopping for gas" is quite active, but as yet there have not been many changes of consumers. People seem to be quietly accepting the reduction they already have, and waiting to see if there will not be another. The Manhattan Company having made the first price, the other companies drop down to it, and should the former company reduce again the others would probably follow; but, as yet, things are not sufficiently exciting for them to lead off in going lower.

The only result of the fight thus far is an alliance, offensive and defensive, between the Mutual and the Municipal Companies as against the Manhattan. Neither company to oppose the other, but both to secure all they can from the Manhattan. "How sweet for Brothers to dwell together in Unity." This may be the beginning of crystallization, but there must be a good deal more heat before perfect amalgamation is secured. Who can stand the hottest fire, and not get melted, remains to be seen. The whole business of opposition is wrong. There is no money to be made by fighting. Conciliation, concession, and consolidation all round is much better for both stockholders and consumers than continued controversy. One gas company is enough for any place, and the sooner New York is supplied by one company, organized on an honest working basis, the better it will be for all concerned.

Opposition "Pro Bono Publico," is well, perhaps, financially, so long as prices are high on all sides; but the extreme reductions in price have a tendency to distract the attention of those "laboring for the public good" to diminished receipts and vanishing dividends rather than the "Dear Public."

Lighting by Electricity.

Ordered,—[*Friday, 28th March*, 1879]—That a Select Committee be appointed to consider whethether it is desirable to authorize Municipal Corporations or other local authorities to adopt any schemes for lighting by Electricity; and to consider how far, and under what conditions, if at all, Gas or other public companies should be authorised to supply Light by Electricity:

Committee nominated—[*Thursday, 3rd April*, 1879]:—of—

Lord Lindsay.	Dr. Lyon Playfair.
Mr. Spencer Stanhope.	Sir U. Kay-Shuttleworth.
Mr. Bruce.	Mr. Adam.
Earl Percy.	Mr. Mitchell Henry.
Mr. Alfred Gathorne-Hardy.	Mr. Christopher Talbot.
Mr. Hardcastle.	Mr. Arthur Moore.
Mr. Heygate.	

Ordered,—That the Committee have power to send for Persons, Papers, and Records.

That five be the Quorum of the Committee.

Ordered,—[*Monday, 7th April*, 1879]:—That Mr. Puleston and Mr. Rylands be added to the Committee.

Ordered,—[*Thursday, 1st May*, 1879]:—That Mr. Adam be discharged from further attendance on the Committee.

That Sir David Wedderburn be added to the Committee.

Report of Select Committee.

The Select Committee appointed to consider whether it is desirable to authorise Municipal Corporations or other Local Authorities to adopt any schemes for Lighting by Electricity; and to consider how far, and under what conditions, if at all, Gas or other Public Companies should be authorised to supply Light by Electricity:—Have agreed to the following Report:

The general nature of the electric light has been well explained in the evidence of Professor Tyndall, Sir William Thomson, Dr. Siemens, Dr. Hopkinson and others. It is an evolution of scientific discovery which has been in active progress during the whole of this century. Essentially the electric light is produced by the transformation of energy either through chemical or mechanical means. The energy may be derived from a natural force, as for instance, a waterfall, or through combustion of a material in the cells of a voltaic battery, or of fuel in a furnace. The energy being converted into an electric current, may be used to manifest electric light by passing between carbon points, or by rendering incandescent solid bodies such as iridium. A remarkable feature of the electric light is, that it produces a transformation of energy in a singularly complete manner. Thus the energy of one horse power may be converted into gaslight, and yields a luminosity equal to 12 candle power. But the same amount of energy transformed into electric light produces 1,600 candle power. It is not therefore surprising that while many practical witnesses see serious difficulties in the speedy adaptation of the electric light to useful purposes of illumination, the scientific witnesses see in this economy of force the means of great industrial development, and believe that in the future it is destined to take a leading part in public and private illumination. There is one point on which all witnesses concurred, that its use would produce little of that vitiated air which is largely formed by the products of combustion of ordinary illuminants.

Scientific witnesses also considered that in the future the electric current might be extensively used to transmit power as well as light to considerable distances, so that the power applied to mechanical purposes during the day might be available for light during the night. Your Committee only mention these opinions as showing the importance of allowing full development to a practical applicationof electricity, which is believed by competent witnesses to have future important bearings on industry.

So far as the practical application of the electric light has already gone, there seems to be no reason to doubt that it has established itself for lighthouse illumination, and is fitted to illumine large symmetrical places, such as squares, public halls, railway stations, and workshops. It is used in Paris for lighting shops which require a light by which different colors may be distingnished, and has recently been used in England for the same purpose with satisfactory results. Many trials have been made for street illumination with greater or less success.

Compared with gas, the economy for equal illumination does not yet appear to be conclusively established. Although in some cases the relative economy for equal candle-power is on the side of the electric light yet, in other cases, gas illumination of equal intensity has the advantage. Unquestionably the electric light has not made that progress which would enable it in its present condition to enter into general competition with gas for the ordinary purposes of domestic supply. In large establishments the motors necessary to produce the electric light may be readily provided, but, so far as we have received evidence, no system of central origin and distribution suitable to houses of moderate size has hitherto been established.

In considering how far the Legislature should intervene in the present condition of electric lighting, your Committee would observe, generally, that in a system which is developing with remarkable rapidity, it would be lamentable if there any legislative restrictictions calculated to interfere with that development. Your Committee, however, are not in a position to make recommendations for conditions, which may hereafter arise, but at present do not exist, as to the distribution of electric currents for lighting private houses from a central source of power. No legislative powers are required to enable large establishments, such as theatres, halls, or workshops, to generate electricity for their own use.

If corporations and other local authorities have not power under existing statutes to take up streets and lay wires for street lighting or other public uses of the electric light, your Committee think that ample power should be given them for this purpose. There seems to be some conflict of evidence as to whether the existing powers are sufficient or not. But even in regard to local authorities it would be necessary to impose restrictions upon placing the wires too near the telegraph wires used by the Post Office, as the transmitting power of the latter would be injuriously affected by the too close proximity of the powerful electric currents needed for producing light.

Gas companies, in the opinion of your Committee, have no special claims to be considered as the future distributors of electric light. They possess no monopoly of lighting public streets or private houses beyond that which is given to them by their power of laying pipes in streets. Electric light committed to their care might have a slow development. Besides, though gas companies are likely to benefit by the supply of gas to gas engines which are well suited as machines for producing electric light, the general processes of gas manufacture and supply are quite unlike those needed for the production of electricity as a motor or illuminant.

Your Committee, however, do not consider that the time has yet arrived to give general powers to private electric companies to break up the streets, unless by consent of the local authorities. It is, however, desirable that local authorities should have power to give facilities to companies or private individuals to conduct experiments. When the progress of invention brings a demand for facilities to transmit electricity as a source of power and light from a common centre for manufacturing and domestic purposes, then, no doubt, the public must receive compensating advantages for a monopoly of the use of the streets. As the time for this has not arrived, your Committee do not enter into this subject further in detail than to say, that in such a case it might be expedient to give to the municipal authority a preference during a limited period to control the distribution and use of the electric light, and failing their acceptance of such a preference, that any monopoly given to a private company should be restricted to the short period required to remunerate them for the undertaking, with a reversionary right in the municipal authority to purchase the plant and machinery on easy terms. But at the present time your Committee do not consider that any further specific recommendation is necessary than that the local authorities should have full powers to use the electric light for purposes of public illumination; and that the Legislature should show its willingness, when the demand arises, to give all reasonable powers for the full development of electricity as a source of power and light.—*Official Report, printed by order of the House of Commons.*

The Gas Supply of Nakskov.—Sir—In addition to my statistical data which you published in No. 841 of the *Journal*, psge 991, I take the liberty of mentioning, with reference to the note in the "Circular to Gas Companies," that, of course, only one kind of gas is supplied. There is commonly but one service leading into the house; and from this, one pipe branches off to supply the lighting, and another to supply the cooking gas, each with a separate meter. It is permitted to fix one burner for lighting the kitchen to the cooking gas pipe, the consumption of which is charged at cooking gas price. Of the gas meters in use, 261 are for lighting, and 310 for cooking gas. The service-pipes from the main to the inside of the house are laid by the gas company free of expense. The meters are sold to the consumers at cost price, and, if desired, may be paid for during a period of five years, by quarterly instalments, with 4 per cent. interest added. Internal fittings, lamps, cooking and heating stoves, etc., are supplied on the same terms by the gasfitters, the payment being guaranteed them by the gas works administration. Consumers have thus the opportunity of having their houses fitted for gas without any immediate cost, and the fitters, having payment guaranteed, exert themselves to find consumers. Gas, in fact, has become the universal fuel even of the poorer classes of Nakskov. All the meters are inspected and read of monthly. The system of having reduced prices for cooking and heating gas was commenced in 1863, and has consequently stood the test of 16 years working.—C. J. Hanssen, C. E., in Correspondence *London Journal of Gas Lighting.*

[From the London "Journal of Gas Lighting."]

British Association of Gas Managers.

ANNUAL MEETING AT NEWCASTLE-UPON-TYNE.

Mr. W. Sugg (London) read a paper on

LIGHTING BY GAS AND ELECTRICITY.

In the early part of last year it was proposed to light the Avenue de l'Opéra in Paris by means of electricity instead of gas. Already the Jablochkoff electric candle had been shown to a few scientific men, and a company had been formed to bring out the new invention, which appeared to be simplicity itself. There was an apparatus producing an electric light without the well-known Serrin clockwork lamp, to which scientific men had been accustomed since the days of Holmes and others. Evidently this was a new point of departure in electric lighting, and as such it was hailed by scientific men.

It was not at first seen that electricity would enter into competition with gas as a means of street lighting, but as soon as the company was formed regular exhibitions of the new electric light were given at the works of the company in the Avenue de Villiers, and comparisons were instituted between the new light and gas light. The comparisons, as I then saw, were most unfairly made, the gas being placed at about 15 feet from the floor of the room in which the trials of the lights were conducted, while the electric light was only 7 feet from the ground. Four of the new lights were placed on 7-feet standards, and two large chandeliers, each having a number of common iron burners of the most gas-destroying type, were hung from the ceiling; the lights being, as I have said, about 15 feet from the ground. Supposing the two chandeliers were hung from the ceiling so that the lights were at the same level as the electric lights, I think the amount of light given by them would have been equal to that given by the electric light. But it is clear that in the comparison made, at the distances I have mentioned, the gas was most heavily handicapped. I do not mean to infer that the electric light company designedly selected the worst burners to try against the electric light; on the contrary, I have reason to believe that the lights were such as might be bought anywhere in Paris, and, in fact, were such as were generally used in cafés and other large public rooms. As gas light of an ordinary type, it was fair to take them as samples. The only unfair part of the comparison was the manner in which the gas was placed in the competition with electric light. I more particularly mention this first occasion, because I have found since, in almost every case in which experiments have been made by electricians against gas, there have been equally unfair means taken to depreciate gas and show an untrue effect with the electric light.

I think experiments made in this manner are utterly unworthy of scientific men, and the effect of such one-sided work is to debase science in the eyes of the general public. Gas and electricity must stand or fall by their merits, and it is of no more use to endeavor to bolster up a defective system of lighting by false statements and one-sided experiments than to stand idly by and let the public be misinformed without an attempt to put them in possession of the true facts of the case.

One thing is certain, and that is that, after the preliminary trials I have mentioned, both scientific men and the public, overlooking all its defects, which were said to be of a temporary character, were entirely carried away by their enthusiasm for the new light. It was resolved by the Municipality to light the Avenue de l'Opéra with the new light during the Exhibition, and a fixed price having been agreed upon between the parties, this magnificent new street was at the opening of the Exhibition supplied with 62 of the Jablochkoff lights.

Notwithstanding the lamentable unsteadiness of the electric light, it found favor with the public, because it was immensely superior to the ordinary flickering yellow gas lights. It evidently fulfilled a latent desire on the part of the Parisian public for more light in their most frequented thoroughfares. The oxygen light of Tessie du Motay, which had been withdrawn after a short trial, had left them unsatisfied, and till the advent of the electric light a considerable time had elapsed without any initiative having been taken by the Paris Gas Company to show an improved system of gas lighting.

Therefore it was, I think, that the electric light, thus answering to the latent desire on the part of the public, met with a more enthusiastic reception than it otherwise would; more even than it merited, for the light was most irregular in illuminating power, varying as much as 50 per cent. in the space of a few minutes. Indeed, it cannot be said that even for a single minute was it constant. A large gas light working on a very bad meter with a little water in the service would more nearly express the irregularities of the electric light than anything else. The illuminating power of these lights was stated to be equal to that obtainable from 700 or 800 candles. We know that this was a gross exaggeration, but it illustrates how much scientific men were carried beyond the power of reason by their enthusiasm for the new light. As a mode of street lighting it failed in a most important requirement: It was not continuous between the hours of sunset and sunrise. At midnight it was extinguished, and the regular gas lanterns were called into requisition to carry on the lighting till sunrise. Thus a double system of gas lighting and electricity had to be maintained.

Some among us had the pleasure of visiting Paris after the meeting of this Association last year, in company with three American gentlemen who now form part of the British Association of Gas Managers. Major Dresser, Greenough, and Forstall have left behind them most agreeable memories, and have, as it were, linked us to our American brethren in a tangible manner. We now feel that in all our meetings they will be present with us in thought, and in our work and discussion we address ourselves to them as well as to those who are present. In company with these gentlemen and others, including your late president, Mr. C. Woodall, who has devoted a considerable amount of time and trouble to the investigation of the modes of electric and gas lighting in use, we made a careful examination of all the systems of electric lighting in use in Paris at the time of our visit. We were all struck with the fact that the large amount of light which was stated to be given by the electric lights did not appear to be present; the volume of light fell far short of our idea of what it ought to be, if the statements made by the electricians were correct. We soon came to the conclusion that they were not correct, and subsequent experiments, by M. Leblanc, the Chief Gas Examiner of Paris, have confirmed us in our idea of the real illuminating power given by the electric light. We thought that the amount of light could not exceed at any time more than 150 candles from one light. We now find that it does not average more than 120 candles. The public were therefore mislead by the statement made at the first appearance of the electric light.

I regret to have to say that even at the present time electricians do not seem to have made up their minds to state with anything approaching to accuracy what is the real illuminating power of their lights. It is next to impossible to obtain any reliable information as to the cost or illuminating power of any of these systems. I will mention an example of the nervousness of electricians as to this question of illuminating power. At the recent exhibition of electric lighting apparatus at the Albert Hall, there were two electric light photometers exhibited—one by Mr. Keates and the other by myself. Although the authorities invited the electricians to bring their lamps to be tested for illuminating power, and Mr. Keates' assistant kindly attended to try them, yet it was found impossible to get the electricians to be ready simultaneously with the exhibitors of the engines which worked the electric machines. When the engineers were there, the electricians were not, and vice versa; so the trials had to be given up. I have, therefore, for the purposes of this paper, compared the sometimes slightly conflicting evidence of those who have made trials of the electric lights in various places, in order to give you the best idea of the relative positions of the two lights as they stand to each other at present, and I then propose to make some remarks upon the future of the gas and electric light.

First I will take the Avenue de l'Opéra. There were in all 62 electric lamps in the Avenue. The machines setting in motion the current of electricity producing the light were what are called the "Double Gramme." The length of the Avenue is nearly 1,000 yards; the width of the road from house to house is 90 feet; the width of the carriage-way is 50 feet. The Place de l'Opéra, at its intersection with the Boulevards, is 200 feet from house to house, and 450 feet long.

This Place is lighted by 22 Jablochkoff lamps, and the machine producing the electric current creating the lights is worked by a 20-horse nominal engine fixed in the basement of the Opera House. The next section of 16 lamps is worked from a Double Gramme machine, driven by an engine of 20-horse power fixed in the Rue Gaillon. The next section, also of 16 lamps, is worked from a Gramme machine and a 20-horse power engine fixed in the Rue d'Argenteuil. The last section consists of the lamps in the Place du Theatre Francais. They are 14 in number, and the engine and the machine for them are fixed in the basement of one of the houses of the Avenue. Each of the lamps is provided with four candles, only one of which is burning at a time. The whole four are inclosed in an albatrine or white glass globe, about 18 inches in diameter. One of these candles burns a little over an hour. At the end of that time the current must be switched off from the one which has been burnt down to the fresh one next it. So it is necessary that an attendant shall go to every lamp once in an hour, and turn on the current to the new candle. The lamps are lighted at about an hour after sundown, and are all extinguished at midnight. The gas lamps, if they are not already lighted up, must then be put into requisition to carry on the lighting till sunrise.

According to the official report, from the 30th of May to the 10th of October, 1878, a little over four months, there were no less than 60 extinctions, lasting from 1, 2, 3, 5, or 10 minutes up to 15, 30, or 45 minutes. The Company, it is said, hopes to do better. There are no fines to pay if they do let

the lights out, and the Paris Gas Company is kind enough to light up when ever the electricity is indisposed.

The amount of light given by each of these lights is stated by M. Leblanc and M. Th. Levy to be, when they tried it at the Avenue de Villiers, equal to that given by 285 candles, in a horizontal line, when the Jablochkoff candle is not covered by an albatrine globe. This light is too painful to the eyes, and from its want of volume it is useless for lighting streets or houses. To render it useful it must therefore be surrounded with an albatrine globe, and then the amount of light given in a horizontal line is said by these gentlemen to have been equal to from 171 to 190 candles; but the electric light does not, like an Argand burner, give its light equally in all directions. Sometimes the voltaic arc is nearer to the screen at the front of the candles, and at otherf it is at the back of the candles. I need not tell you that on a short photometer, such as has hitherto been used in testing the power of the electric light, this little distance makes a very important difference. Such a very exact savant as M. Leblanc would, however, be very unlikely to overlook these points, yet I do not think he would be disposed to give so much credence to these experiments if they were regularly made every day, just as gas is tested. But he found that although the light in a horizontal direction was equal to what I have stated, yet that effective light given on the ground in a diagonal direction was only equal, in round numbers, to 115 candles; so that in practice, although the beautiful white fronts of the houses in the Avenue de l'Opéra were lighted to the extent of, on an average, about 160 candles, yet on the ground there was only the light of 115 candles.

It is remarkable that in the experiments carried out at Westgate-on-Sea by Messrs. Bennett and Valon, they found that the light given in a horizontal line by a Jablochkoff lamp was there equal to 197 candles. The difference between their experiment and that I have mentioned is easily to be accounted for by a possible difference in the speed of their engine and that used in Paris. I think that in all estimations of the electric light the speed of the dynamo machine ought to be taken, as well as the number of lights in the circuit at the time of the trial, simultaneously with the photometrical experiments. This has a most important bearing on the question of cost.

Now as to this question of cost. This is, as told me by an eminent Paris electrician, a very delicate question. I shall give it you in figures founded on my own experience and observation, checked by those of the most experienced engineers who have tried it.

M. Th. Levy estimates that his experiments show that to obtain a light of one Jablochkoff lamp, producing the effect of 115 candles on the ground, it is necessary to employ the force of 1¼-horse power when there are 16 lights burning produced by the force of a 20-horse power engine. This is corroborated by the experiments of Messrs. Bennett and Valon, who obtained six lights of little more than that obtained by Messrs. Leblanc and Levy, with a force of rather over 10-horse power, or at the rate of one light for 1.6 horse power. This is further corroborated by Messrs. Keates and Bazalgette. So we may take it that we could get one light of 120 candles in all directions for 1¼-horse power. The Electric Light Company say they hope to get three lights from 1-horse power, but how they are going to do it, and what is to be the power of these lights, they do not condescend to inform the world. Thus the 62 lights in the Avenue de l'Opéra require 92-horse power to keep them going.

I need only say with respect to the hopes of the Electric Light Company, that, considering that the conclusive experiment of Dr. Hopkinson, given in evidence before the Select Committee on Lighting by Electricity, shows the conversion of motive force into light to be so perfect with the Siemens dynamo machine, that the astonishing result of 90 per cent. in light is obtained from the motive force employed, these hopes are doomed never to be realized. The total amount of light obtained from the 62 lights is at the rate of 120 candles per light all round, or 7,440 candles.

Table No. 2, appended to this paper, is my estimate of the cost of the electric lighting in the Avenue de l'Opéra, taking the figures, as to the working expenses, of M. Levy, and adding the capital charge and interest on the capital expended. This, you see, amounts to the sum of £19 11s. 4½d. per hour for 62 lamps, or 6s. 3¾d. per lamp per hour. But we were told by the Chairman of the House of Commons Committee on Lighting by Electricity that the commercial value of the electric light is that which the Electric Light Company charge for it. Now, without disputing his dictum, it seems to me that we, as gas engineers, are at liberty to examine into the cost ourselves, and this I have laid before you for your information and criticism.

I now address myself to the comparison of gas and electricity as a means of lighting the Avenue de l'Opéra. The Electric Light Company of Paris has undertaken to light the Avenue de l'Opéra for the period of one year, beginning from the 15th of January, 1879, for the sum of 3d. per light per hour, including all charges. The total cost of the 62 lights is therefore 18fr. 60c. per hour, or, in English money, 15s. 4d. Now for this sum they give a light which is, as I have stated, imperfect in almost every requirement for street lighting, and which must have all the regular arrangements of gas lighting to do the work when the electricians are gone to bed, or when they cannot get their capricious apparatus to work. To the cost of the electric light, high as it appears to be, must be added the cost of the installation of the gas. and the cost of gas for the 2,000 hours in the year from midnight to sunrise. This will be 620,000 cubic feet, plus the lamplighters' wages.

The number of gas burners replaced by the electric lights was 344, each burning 5 cubic feet per hour. Each of these jets gave an effective light on the ground equal to 10 candles, or a total of 3,440 candles; consequently the electric lights gave a light of 4,000 candles more than the gas. The Paris gas burners do not, however, do as much good with the gas as they ought. They are all iron burners. If the 1,720 cubic feet of gas consumed by the 344 burners had been consumed in the 200-candle burners such as shown here, they would have given the light of at least 6,500 candles for that quantity of gas, or only 900 candles less than that given by the electric lights; so that if forty 200-candle burners had been placed on the columns on the Boulevards and in front of the Opera, instead of the electric lights, there might be a continuous, steady, bright, white light, superior to the electric light, for a trifle more than the gas cost before.

The actual position of these lights might be as follows :—Six globe lanterns on the ornamental columns in front of the facade of the Grand Opera, fitted with burners consuming 25 cubic feet per hour, and giving the light of 90 candles each. Eight lanterns of a globular form, one on each of the safety posts in the Place de l'Opéra, each of these to have a burner consuming 56 feet of gas per hour, and giving a light of 200 candles each. Six lamps fixed in the Place du Theatre Francais, fitted with burners each consuming 56 feet per hour, and giving the light of 200 candles each; and 23 in the Avenue, fixed on columns, the same pattern as the Paris columns, but 15 feet high, placed in the centre of the carriage-way, each lamp constituting a refuge. These would each burn 56 feet of gas per hour, and give the light of 200 candles each. The total quantity of gas consumed for the entire lighting would be 2,222 cubic feet, and the total amount of light in candles would be 7,940, or 500 candles more than can be produced by the electricity.

Thus, by this new system of lighting, the excess of the consumption of 502 cubic feet per hour over the usual amount consumed before the advent of the electric light—viz., 1,720 cubic feet per hour—the Parisians might have a better light, perfectly steady, reliable, and working from sunset till sunrise without attendance, superior in illuminating power by 500 candles to the electric light, with all its trouble in engines, machines, and attendants. Further than this, the unanimous verdict of the public is that the gas light thus produced is soft and agreeable to the eyes, which the electric light is not.

The cost of the old gas lighting by 344 burners was 7fr. 22c. per hour for the entire Avenue, the Place de l'Opéra, and the facade of the Opera, and the light given was 3,440 candles. The cost of the electric lighting for doing the same work is, at the present price charged by the Electric Light Company, 18fr. 60c., and the light given is 7,440 candles, or 4,000 candles more than the old gas lighting. Thus the illuminating power is increased 186 per cent., and the cost is increased 163 per cent.

Now you perceive why you did not see the great difference which you were led to expect from the exaggerated statements which had beed made in the public journals of France and England about the incredible number of candles given by the electric light, when at midnight the electricity was replaced by gas. The 50,000 candles at first talked about has dwindled down to 7,440 candles. If, however, the 1,720 cubic feet of gas formerly consumed by the 344 old 5-feet per hour burners had been consumed in such new Argand burners as I have before mentioned, the result would have been a production of light equal to 6,880 candles, or only 580 candles less than that given by the electric lights which superseded those gas lights. Thus, the increase of light produced by the electricity is only 12 per cent. more than might have been produced from a proper use of gas, while the loss, at the exceeding low figure of 7fr. 22c. per hour for the 62 lights shows an increase of 125 per cent. on the cost of gas to produce the same amount of light.

The cost of the new lighting by gas which I have proposed, and which I have demonstrated to you is practicable, will be 9fr. 42c., or less than half the price now being paid by the Municipality for the imperfect lighting by electricity. All this bother of electric machines, engines, and candles results in the expenditure by the Paris Municipallty of a large sum of money for doing in an inefficient manner the work which can be efficiently performed by the Paris Gas Company for less than half the money, without any bother at all.

Is it not clear that if the Paris Gas Company could have come forward in the first instance and said they were able to give this superior light for the small sum of money just mentioned, the Avenue de l'Opéra would in all

probability have never been lighted by electricity? And this more surely because the gas being first fixed, and constituting the standard, the public would never have accepted the flickering and uncertain electric light in place of the steady and brilliant gas lights. Unfortunately, there were only the old flickering yellow bat's-wing burners to represent gas, and the electric light had it all its own way; but in the end the best and cheapest must win, and that is in the future for gas.

It is said of the late Duke of Wellington that, being present at a trial of gun-cotton, which it was predicted would supersede gunpowder, and finding the destructive effect it had on the gun from which it was fired, he quietly remarked before going away, "What a splendid improvement gunpowder would have been on gun-cotton, if gun-cotton had been invented first." So we might say with regard to street lighting by gas and electricity.

In the Rue du Quatre Septembre, a street about half the length of the Avenue de l'Opèra, the Paris Gas Company has put up 80 lanterns, with burners composed of a ring of flat-flame iron burners, each burner consuming nearly 50 cubic feet of gas per hour. The total quantity burned by the 80 burners is 112 cubic metres, or 3,923 cubic feet per hour. Each of these burners gives, it is said, the light of 125 candles. The light given by all the 80 burners is therefore 10,000 candles, or 2,560 candles more than the electric light in the Avenue de l'Opéra. Now, if this quantity of gas were consumed in 60 200-candle burners, the amount of light obtained would be equal to 12,000 candles, or 4,560 candles more than that obtained from the electric light in the Avenue de l'Opéra. (Note that the Rue du Quatre Septembre is only half the length of the Avenue de l'Opéra.) The real cost of this lighting, at the rate for gas paid by the Municipality, is 16fr. 80c. per hour. The Paris Gas Company is only charging one-third of this sum, regarding the new light as being an experiment; but I think it would be much better if they would consider it as a serious mode of lighting, and give light for light and lamp for lamp, in comparison with the electric light.

In the Place du Chateau d'Eau there are 77 lamps fitted with gas burners; 19 of these burn 114 litres of gas per hour, and the other 58 burn from 740 to 800 litres per hour.

In the Halles Centrales there are two pavilions lighted—one by electricity and the other by gas. They are both lighted for 4,000 hours per annum, or from sunset to sunrise. In the pavilion or quarter of the building devoted to the electric light there are six electric lights burning at a cost of 1fr. 80c.; or about 1s. 6d. per hour for the six lights, and the amount of light given is equal to 720 candles. The old lighting by gas was done by 20 bat's-wing burners, each consuming 5 cubic feet per hour, and the total amount of light given was 200 candles, at a cost of 42 centimes per hour, or 4¼d. for the 20 lights per hour. Now, if six burners of 120-candle power each, and consuming 35 cubic feet per hour each, were fixed in the place of the electric lights, they would produce the 720 candles for the sum of 90 centimes, or 9d. per hour for the entire lighting, instead of nearly 18d. for the same work done badly by the electric light. (Note that there were 24 extinctions and 54 electric lamps out in the month of April last, the gas having burned steadily from the time it was commenced, without any extinctions or wavering.)

I shall not take up your time by any consideration of the lighting of the Magasins du Louvre by electricity as compared with gas, or the lighting of the Hippodrome. With respect to the Magasins du Louvre, it is more than probable that the question of cost, or even efficiency, does not enter into the calculations of the proprietor. Those who have seen this vast shop, where everything is sold, must have observed that the gas lighting is primitive. The lustres and brackets are massive and even gorgeous, but as an example of the comparative effect of lighting by gas and electricity, it is about the same as a comparison between the old Roman lamp with that perfection of an oil lamp, the Carcel. Besides, the electric light has been for this establishment, as well as for others in this country, an excellent advertisement. It is a matter of little importance whether the light is reliable or not, there is always the gas lighted and ready to be turned up at a moment's notice when the electric lamps go out. In most cases the gas and electricity are kept going together. I believe the assistants complain bitterly of the electric light, and ladies say that it is not good as regards matching colors.

The Hippodrome is a large circus, fitted with a sliding roof, so that in the summer the performance is under the open sky. Here again the building is fitted for gas as well as electricity. There are two systems of electricity, one being the Jablochkoff and the other the ordinary point-to-point carbons. The volume of light it here very deficient, and I have no doubt that when the novelty of the electric light has worn out the management will have to supersede the electricity with gas, or use both gas and electricity simultoneously.

Coming now to the attempt to supersede gas by electricity in this country, I take first the lighting of the Albert Hall, because evidence upon this subject has been given before the House of Commons Committee on the Electric Light, by a very high authority—I allude to Dr. Siemens. It is difficult to imagine how the learned Doctor arrives at some of the astonishing statements he has made with respect to gas. But this paper would be most incomplete if it did not make an attempt to place before you some of the statements made, so as to bring them into the scope of the discussion, with a view to obtain an expression of opinion from some of the members of this Association, whose practical knowledge of gas-making is considerably in advance of that which could be possessed by the learned Doctor.

Dr. Siemens, in his comparison of gas with electricity, takes as the unit of comparison 1000 standard candles of light per hour. He then states (Question 136), "That an Argand burner produces 1000 candles of light per hour, with a consumption of 312 cubic feet of gas, and to make this gas, 56 lbs. of coal would have to be used in the retort." Here I think I see a grave error; 312·5 cubic feet of gas from 56 lbs. of coal is 12,500 cubic feet to the ton; therefore I think the Doctor must have been speaking of cannel coal, probably Lesmahagow. This would be 30-candle gas at least; 312·5 cubic feet of such gas will give at least 2031¼ standard candles. As he has taken electricity in its most scientific form, so, for a fair comparison, must he take gas in its at present most perfect system of burning. If we burn the gas in such burners as you see here on the table, you can get the light of 6¼ candles from every cubic foot of 30-candle gas. Mr. King, of Liverpool, whom you will doubtless consider a better authority on this subject than even Dr. Siemens, has stated that he has obtained 5·1 candles from a cubic foot of 22 candle gas.

Dr. Siemens further states that he found that with a gas engine (I presume on Otto engine) he obtained the light of 1000 candles with an expenditure of 151 cubic feet of gas. This would be a development of 4-horse power to do this work with one of his own dynamo machines, which I consider the most powerful, and this accords exactly with the experiments that were made by me under the direction of the Lighting Committee of the Gas Light and Coke Company. We found that with a small Siemens machine we produced an average light of 1000 candles with an indicated power of four horses, and with a consumption of 40 cubic feet of gas per hour, the illuminating power and indications of horse power being taken simultaneously. 37 cubic feet of 30 candle would certainly do as much work as 40 feet of 16-candle gas. In fact, I am certain that if the air supply of the engine had been properly regulated for the quality of the gas, it would have been found that 30 cubic feet per hour would have done the work. From this it is clear that the conversion of gas lighting power into electric force does not work out so advantageously as it was thought to do.

Dr. Siemens says that 151 cubic feet of gas is produced from 25·2 lbs. of coal, and he deduces from this calculation that if 25 lbs. of coal be used to produce gas, and that gas is applied to work a gas-engine, it will produce as much light as 56 lbs. of coal converted into gas would do, if it were burned in gas burners to produce light directly. I think I have shown that the Doctor's figures are capable of another interpretation. Gas making is not a wasteful or an unscientific mode of producing illuminating power. In making his comparison of what can be done with 56 lbs. of coal in producing the electric light, Dr. Siemens does not take into consideration that in using his coal to produce steam, and with that force producing the electric light, the whole of his material is used up, leaving nothing but dust as a residual. On the contrary, in using the 56 lbs. of coal to produce gas, he obtains 312·5 cubic feet of gas, and he has a quantity of coke and tar, besides ammoniacal liquor. If the net value of these products is taken into the calculation, quite another view of the matter will be shown. I think that, taking into consideration the ease with which gas is conveyed into every nook and corner of towns, it will be found better to burn gas to produce light, which can be managed by any unskilled person, and divided into any size flame without much loss, than convert its force into a motive power to produce electric lights, which cannot be divided into small lights without great loss, and which require highly-trained hands to manipulate them.

I regret that the limits of this paper do not permit me to go so fully into the lighting of the Albert Hall as I could wish. This hall is lighted usually by gas, by means of 30 of what may be called sun burners suspended from the roof. Each of these has a total of 105 small fishtail iron jets. Thus we have a grand total of 3150 of these small fishtail jets in the aggregate number of 30 sun burners. These sun burners have no reflectors, but the light given from them is a little assisted by a whitened coved ceiling. The consumption of all the sun burners, at the rate of 2·5 cubic feet per hour for each jet, is 7875 cubic feet. With such burners a cubic foot of 11-candle gas will only give the light of 1·5 spermaceti candles, or 7·5 candles per 5 cubic feet of gas burned.

The total amount of light in spermaceti candles is 11,862·5 candles. The lights in the arcade round the upper gallery are 23 in number, with 5 iron jets in each, which give the light of 2 candles per cubic foot of gas consumed. The total consumption of these burners is 460 cubic feet, and the light given for it is 920 candles in all. Thus the total amount of gas consumed

in an evening of three hours is 25,000 feet, and the total amount of light given by this very unscientific lighting is for each hour, with a consumption of 8,335 cubic feet of gas, 12,785 candles. With this the highly scientific electric light is compared, and without taking into consideration any charge for the engine to drive five Siemens dynamo machines, which, small as they are, will need a full-size 30-horse power engine to work them, without any charge for the copper leading wires or for the lamps, five in number, and ignoring any charges for rental or interest on capital, it is gravely stated in evidence, on high scientific authority, that there is a considerable saving effected if this building, and, by inference, similar buildings, are lighted by electricity in place of gas. I say that such misleading statements are unscientific and unfair. In the first place, it cannot be seriously entertained for a moment, by any scientific man, that such a whizzing, fizzing, screaming, roaring, fluttering and sputtering concern as these five lamps, could be accepted by the public as a permanent mode of lighting.

I was present at the lecture given, on the occasion of the exhibition at the Albert Hall, by Mr. Preece, a gentleman whose unbiassed and highly practical opinion, given, as it is at all times, on any practical question, with the most perfect clearness and evidence of a thorough understanding of the subject, affords the highest pleasure to every one who hears him. After the lecturer had described the different machines and lights (which by-the-by were most uncontrollable, even in the presence of Royalty), these large lamps were lighted up, and the noise they made—more than sufficiently audible even on the platform—very sensibly affected the Duke of Edinburgh in a speech he made thanking the lecturer. I was even led to believe myself that some of the audience were hissing. What the effect of these ill-behaved, spoiled scientific pets would have been on the sensitive, nervous temperament of a *prima donna*, it is too much to contemplate.

Much has been said on the question of the improvement of the acoustic properties of the Albert Hall by the use of the electric light; but really until some means has been discovered to make the light burn steadily and without noise, it sounds like a dismal joke to mention such a thing.

In its present state, it is not worth while to go into the question of the cost of the electric light at the Albert Hall. I shall defer that consideration till I see that it can seriously enter into competition with gas to light the Hall. But I will tell you what can be done with 2,500 cubic feet of gas consumed in three hours, for lighting the Hall, if it is employed as we can now employ it. This quantity of gas, burned in such Argand burners as you see before you, will easily produce from 16-candle gas a total of 100,000 candles of light, or more than 33,000 candles per hour. Now observe that it is also possible to use these burners in lamps which take their supply of air from outside the hall, and return the vitiated air to the exterior of the building, so that the air of the interior is not affected in any way by the products of the gas, or by the air required to promote combustion. So the acoustic properties of the Hall may be as good with gas as with electricity. This light is steady, constant, white, and pure. Remark that, unlike the vaunted purity of the electric light, it does not require gold reflectors to neutralize its ghastly paleness.

Now what can the electricians offer comparable to this? It is stated that the light given by each electric light is equal to 6,000 candles, and that the grand flood of light from them is equal to a total of 30,000 candles. I pledge you my word, as a photometrician, that if this be so they must be the very smallest parliamentary candles I have ever seen.

On the evening of Mr. Preece's lecture your late President and other eminent men who had a perfect knowledge of the subject were present, and they remarked with me that the 30 sun burners alone, unassisted by the arcade lights, were nearly if not quite equal to the electric lights in the volume of light they gave. It is true that the concentrated power of the gold reflectors of the electric light caused a greater amount of light to fall on the floor of the arena, but the total lighting of the hall was little better than the light given by the gas. Now the light from the 30 sun burners we know to be not more than, in round numbers, 12,000 parliamentary candles. This result is extraordinary, and we should be surprised at it if we did not know that the electric light does not possess the volume of light that gas does for an equal measured amount of light. It is therefore clear that for lighting such a building the gas is superior in every respect to the electric light, and if it is desired by the Commissioners of the Albert Hall, they can, by improved modes of using it, certainly obtain that success with gas which I think they will long desire to obtain from electricity.

For lighting streets and large spaces I entirely dissent from the view taken by the authorities who have said that electricity is more convenient and suitable than gas. The elaborate experiments carried out in Paris and on the Thames Embankment do not establish this as a fact, but quite the contrary.

Since it is impossible to obtain complete official information as to the entire cost of the electric light, either on the Thames Embankment or in the Avenue de l'Opera, we adopt the view taken by the Rt. Hon. Lyon Playfair, that the commercial value is what the Electric Light Company is willing to take for it. Thus on the Thames Embankment the price charged is 5d. per hour for the same thing which costs the highly favored Municipality of Paris 3d.

Now, if it is desired by the Metropolitan Board of Works to light the Thames Embankment efficiently, and to the same extent as it is now done by the electric light, they need not go to the trouble of putting up a magnificent engine, or disfiguring the architectural beauty of this very grand work by magnified cobwebs from lamp to lamp, or lamps with reflectors *a la tate du cardinal*. All they have to do is to order in place of each electric light a gas lamp and burner, giving a light of 120 candles, at a cost for each lamp of 1½d. per hour, including all charges, and the work will be efficiently done without any trouble to the Board. Better still, and more worthy of London's beautiful promenade by the river, the Board, if they are disposed to pay to the gas company half of what they now pay to the Electric Light Company, can have a globe lamp with a 100-candle burner on every one of the handsome columns fixed on the Embankment, instead of only on every other one as at present, thereby producing a very much better effect in every way than they can possibly hope to do with the electric light.

What gas can do in the way of street lighting and in lighting large spaces is abundantly and clearly shown in Queen Victoria Street, City, the lighting of which I claim to be superior in every way to that of the Avenue de l'Opera, and in this I am borne out by the verdict of the public. Yet the total cost of that lighting is only three times the cost of the old system of lighting by the usual 5-feet per hour burners, and the total amount of light given in the street is 3,400 candles by the new mode of lighting, as against 660 candles by the old. Thus the cost is three times the old rate, and the illuminating power is six times greater than before. Such lighting is not too much for the busy streets of London, in which there is at night a traffic of pedestrians and vehicles considerably greater than in any other city in the world.

The public imperatively demands an improved street lighting, and, as is clearly shown by the large sums expended on the electric light, are prepared to pay the value for it. It is our work to show how gas can be utilized for this purpose to the fullest possible extent, and, with as little increase in the present cost as we can, to give an improved lighting. But at the same time it must be borne in mind that the action of the local authorities in many places has been to decrease the amount of light, while the increase of night traffic has gone on from year to year.

Reverting to first principles, I have taken, for the purpose of illustrating what public lighting is and should be, a certain standard. This standard is a man lighting his way with a lantern. The light is fixed to a stick, in the manner most approved by our ancestors; it is, in fact, so used in the country at the present time. The height of the lantern from the ground is just 2 feet to the centre of the flame. If the lantern is provided with a parliamentary spermaceti candle, it will, in the position I have stated, light a circle of 4 feet in diameter. The amount of light anywhere on the edge of this circle will be sufficient to enable a man with good eyes to read a leading article in *The Times* newspaper lying on the ground. This light will just enable a man to see his way before him as he walks. In a well-lighted neighborhood, where the local authorities allow to each lamp 5 cubic feet of gas per hour, and there are no shops, it will be found that this is the average kind of light which is found at 7 feet 6 inches from the lamp post. The lamp is 10 feet from the ground, but usually immediately under the lamp post there is a kind of a dark gridiron-like shadow, about 8 feet across, with dark shadows going across the road, widening as they go. These shadows are the greatest possible hindrance to drivers, who cannot be sure if it is really a shadow in the road or a pedertrian. So much are the lamps felt to be a hindrance rather than a benefit, that I believe if all the drivers were asked to vote on the question they would vote almost unanimously for the entire suppression of the lanterns, if they could not have a light without a shadow; but it would be a very different thing if the shadows were eliminated, and there, I think, is the first step to be taken in the improved light of the future.

An improvement which can be made in street lighting, at a very slight cost, is to put a reflector over the burner. This, I believe, was first successfully done by Mr. Woodall, the brother of your late President, at Burslem. He substituted a white porcelain top for the glass top usually seen in street lanterns, and although his example has found few imitators in England, it has been adopted in South America. All the lamps in Rio and Nichteroy are glazed with the Burslem porcelain tiles.

The next improvement is the abolition of the hideous and useless lantern cradle, which is mainly responsible for the troublesome shadows of which I have spoken. Next, if Argands are substituted for flat-flames, there will be an increase of at least 20 per cent. in the amount of light given. In France a great many chimneys are used with Argands in lamps. The railway station at Amiens has Argands only, with chimneys, all over the yards. In England objections are always made with the employment of chimneys; but

I have been told by Mr. J. N. Douglass, the talented Engineer to the Trinity Lighthouse Board, that although they have in use perhaps the greatest number of chimneys of the large and small sizes, yet the amount of breakage, even with the rough weather to which they are often exposed, is so small as to be unworthy of consideration in their wear and tear accounts. Then comes the use of large burners on the crossings, at refuges; and, lastly, comes the use of 20, 50, and 80-candle burners in the most frequented streets.

The public desire larger lights, and if they do not get them with gas, then they will with electricity. It has been foretold more than once that electricity would vanish from the Avenue de l'Opera, the Thames Embankment, and other places where it is used. These previsions have not been realized. The electric light has been adopted for at least one year in Paris, to light several important points in that city. Messrs. Keates and Bazalgette have declared in their report that it has established itself as a light for streets, and that it can reach a distance of 2¼ miles from the central engine station. It is also stated that for lighting railway stations, large factories, shops, picture galleries, and the reading-room of the British Museum, above all things it is the desideratum.

At the risk of being called a gas fanatic, of being told I am struggling to put the clock back, and of resisting improvement, I say I have proved to you that for street lighting gas is in every respect better than electricity. For large public halls it can be used with better advantage in every respect, and without vitiating the air of those halls in any degree. For picture galleries the light is, when properly arranged, pure, white, and steady, and will not hurt the pictures nor vitiate the air. Nor will it increase the temperature of the room in which it is used. I have a small room, 14 feet square, lighted by a 100-candle burner, which, burning for hours in ordinary weather, will not raise the temperature one degree. So for the British Museum gas might be used without shocking the susceptibilities of the fire insurance authorities or endangering the books, and readers might be able to read in comfort, without danger to their sight.

Railway companies are adopting gas for their stations. The London and Brighton Company is about to light its Victoria and London Bridge stations with 80-candle burners, and the Great Northern Railway has already fixed some of these large burners on their platform at King's Cross. A large factory in Glasgow has resolved to try gas with 200 or rather 300-candle burners for their erecting shops, and they will shortly be brought into use.

They are also being used for markets, and the Authorities of the City of London are this moment trying experiments to see how the lighting of Queen Victoria Street will suit the celebrated market where the sanguine expectations of Mr. Reed were falsified, and fresh fish looked stale, and mackerel looked like whiting.

Gas lighting is a progressive science, and if electricity has been galvanized into renewed life by those very ingenious gentlemen and their associates, Messrs. Denayrouze and Jablochkoff, of whom you will have conserved a very pleasant recollection, so have we gas engineers received the *countre-coup* of the shock. We may fairly say that we are not behind in that race which will inevitably result in conferring on mankind one of the most cherished of blessings—more light.

The following tables accompanied the paper:

TABLE NO. 1.

Statistics of the Lighting of Queen Victoria Street and Waterloo Place, London, with Sugg's Large Burners and Lanterns.

Queen Victoria Street (Common Gas).

The lighting consists of—

Thirty 80-candle burners, each consuming 22 cubic feet=660 feet, giving a total of	2,400 candles.
Five 200-candle burners, each consuming 50 cubic feet=250 feet, giving a total of	1,000 candles.

Thus a light of 3,400 candles is obtained from 910 feet of common gas (16-candle), which, at 3s. 6d. per 1,000 feet, costs 38.22d. for the entire lighting per hour, or a light of 88.95 candles per 1 penny cost.

Waterloo Place (Cannel Gas).

The lighting consists of—

Two 200-candle burners, each consuming 45 feet=90 feet, giving a total of	400 candles.
Forty-three 80-candle burners, each consuming 19 feet=817 feet, giving a total of	3,410 candles.

Thus a light of 3,840 candles is obtained from 907 feet of cannel gas, which, at 4s. 4d. per 1,000 feet, costs 3s. 11½d. per hour for the entire lighting, or a light of 81.4 candles per one penny cost.

TABLE NO. 2.

Estimate of the 62 *Electric Lamps on the Jablochkoff System, in the Avenue de l'Opera*, burning from sunset till midnight, each lamp giving a light eqval to 115 spermaceti candles, (burning 120 grains of material per hour) in an oblique line from the lamp to the ground, and from 170 to 190 candles in a horizontal direction from the lamp. The lamps are inclosed in an albatrine globe.

Capital Account.

Two steam engines, like those on the Thames Embankment at Westminster—viz., 20-horse power nominal double-cylinder engines, capable of work-up to 90-horse power, at £400 each	£800	0	0
Three Gramme double machines, at £400 each	1,200	0	0
Fixing counter-shafting and laying the wires in the gtreets, foundation of engines and machines calculated from the cost given by Lt.-Col. Haywood for the Holborne Viaduct experiment)	600	0	0
Sixty-two Jablochkoff lamps and carbon holders, with commutators, at £10 each	620	0	0
Leading wires, with return current and commutators, fixed, 15,000 yards	1,200	0	0
Total	£4,420	0	0
Lamp columns, same as used by the Gas Company	.....		
Interest on £4,420, at 4 per cent., for one year	£176	16	0
Wear and tear on engines, machines, counter-shafting, etc., for one year	260	0	0
Wear, tear, and maintenance of globes, lamps, etc, at 15 per cent	93	0	0
Wear and tear of leading wires and commutators, at 5 per cent	60	0	0
Total	£589	16	0
	Per Hour.		
£589 16s. divided by the number of hours in a year from sunset to midnight (2,073)	£0	5	8¼
Motive force, carbons, attendants, as per M. Levy's estimate (*vide* M. Cernesson's report to the Paris Municipal Council, *ante* p. 90)	0	0	7¼
Total cost per lamp	£0	6	3½
Total cost of the 62 lamps	£19	11	4½

To this must be added the cost of gas from midnight to sunrise required to replace tho electric lamps, which are all extinguished at midnight, or 5s. 9d. for every hour for a total of 344 gas burners.

DISCUSSION.

Mr. F. W. Hartley (London) complimented Mr. Sugg on contributing a very valuable paper to the proceedings of the Association. With respect to Dr. Siemens's statements before the House of Commons Committee on Lighting by Electricity, as to tbe quantity of gas produced from coal and its lighting value, Mr. Sugg and himself had noticed the discrepancies at the same moment. The cost of the electric lights at the Albert Hall was said to be 12s. 6d. an hour, against about 22s. for gas which thoroughly lighted the hall; but it would be easy, by the employment of large Argand burners, to produce as much light as was produced by the present gas burners, for something like 12s. 3d., instead of £1 2s. He (Mr. Hartley) was sorry that Mr. Sugg had confined himself so much to the Jablochkoff system, because there were other important methods, and there was a perfect agreement between Dr. Tyndall, Dr. Siemens, Mr. Cooke, and Mr. Preece that, for electric lighting to be economical, large lights must be used, and not small ones. These gentlemen asserted electric lights of 1,000 candle power each could be produced economically; but arguments in favor of such electric lights broke down when it was considered how those large lights were to be applied. According to Dr. Siemens, they were to be something like 100 yards apart. Streets could be well lighted, under the ordinary gas system, by lamps placed 40 yards apart, for about 14 miles for £1 2s. an hour for gas, while it would require, in order to produce the effect which Dr. Siemens deemed to be necessary, something like 38 of his big electric lights. Without going into any discussion of the possible cost of engines, dynamo machines, conductors, carbons, labor, etc., it would be seen that the "big light" scheme was impracticable; hence they were driven back to the position which Mr. Keates took up—viz., that electric lights for the streets must be comparatively small lights, spaced at short distances. His evidence went to show that as much light could be obtained for 2d. with gas as for 5¼d. by the Jablochkoff system. With gas at 3s. 4d.

per 1,000 cubic feet, it cost, for five-feet burners, two-tenths of a penny each per hour. Two pence was therefore ten times the present cost. Mr. Sugg said the public demanded big lights, and would have them. The public might desire big lights, but what would they say if they had to pay ten times the present charge for street lighting? He might cite one parish in London which was now paying £4,000 a year for gas alone, which, multiplied by ten, gave £40,000. What would the ratepayers say to that? Yet this was cheap as compared with the possible cost of lighting the same streets by the agency of Jablochkoff candles, which now cost 29 times as much as ordinary gas lighting, and would bring the charge up to £116,000 a year, instead of about £5,600, the present cost for gas, lighting, cleaning, etc. The absurdity of the thing appeared at once upon the face of it, for no parish would be taxed to such an extent, or even to the half of it. Were it possible to space the lights more widely apart, Mr. Sugg said he could light streets effectively for three times the ordinary cost, and he (Mr. Hartley) was quite prepared to believe this; still, three times £4,000 amounted to £12,000, while maintenance would be more costly, and he questioned whether a parish would accept such a rating. This was an argument absolutely in favor of gas lighting. If the public wanted large lights they must pay for them; but the moment the charge was put upon they would recoil from it. Coming to the question of the application of the electric light to large areas, he said emphatically there must be one system of lighting, and the best system was by large gas burners. There could not be two discordant and antagonistic lights which spoiled each other. Again, as to the actinic effect, he believed it would be found by-and-by in warehouses, that the colors of cloths would be seriously affected by that quality. He would not say much upon the subject of the production of nitrous oxide, because it was not large in quantity, and it was scarcely necessary to raise that as an objection. An objection which had been raised to gas lighting was that it produced great heat, and vitiated the atmosphere. Although he was not at liberty to say much about it at present, he might mention that he had a few days previously seen a burner for which it was claimed that it evolved a greater amount of light than any other burner, and yet the heat was considerably diminished. He had only seen it experimentally, but the burner delivered its products at so low a temperature as to be perfectly startling, whilst the value of the light was increased, and the apartment was maintained much lower in temperature than usual. There was, therefore, a large field left open for improvement in the application of gas, though electricians seemed to assume that gas lighting had reached its maturity, while, in fact, it was becoming cheaper. They had had as witnesses before the Committee of the House of Commons, Dr. Tyndall and Dr. Siemens, who spoke with positiveness as to the necessity, for economy's sake, of having large electric lights; while the engineers of the Societe Generale d'Electricete asserted that they could do as well with their small lights as those eminent electricians said was possible only with big ones. Not only that, but they sought, as it appeared to him, to impress the Committee of the House of Commons with the notion that they could generate force enough for twice or three times the number of lights they were then working, with the same expenditure of fuel, or without increase of engine power.

Mr. W. Cleland (Linacre, Liverpool) said he had been in hopes there would have been something said on a point which must be extremely interesting to members generally, as it was to himself. They had heard a great deal of the probable result of the contest between gas and electricity, and much was said about improved lamps, the extended distance to which the electric current could be sent, etc. But the fundamental point, upon the practicability or impracticability of which would depend the issue of this contest, was one that had not been touched upon—namely, the possibility of dividing the light without a serious loss of illuminating power. It seemed to him very extraordinary that there should at this time be such a wide divergence of opinion on that subject. They had Dr. Siemens, in his evidence before the select Committee of the House of Commons on Lighting Electricity, positively asserting that the loss of illuminating power through division was as the square of the number of divisions; others asserted it was as the cube. On the other hand, Sir William Thompson as positively maintained it was all a mistake, and that the light could be divided practically without loss of illuminating power. It seemed to him (Mr. Cleland) this was a question, as compared to which all others were mere detail. If Sir William Thompson were right, he thought their industry was in some danger; but, if the others were right, then serious rivalry from the electric light was far off indeed. If an electric light equal to 1,000 candles was divided into 10, and there were obtained not ten 100-candle lights, but ten lights of ten candles—or still worse, ten lights of one candle—then the difference between the possibilities of the electric light and the practicabilities of gas were so vast that gas companies had nothing to fear. This was the point which he thought really ought to be determined, and possibly there were some members sufficiently versed in electricity to be able to decide it. It could not be so exceedingly difficult to take any given electric light, and by dividing it into any given number, ascertain the relative power of the divided lights, for it was the relative power only which it was now so important to determine.

Mr. J. Chapman (Harrow) said he was one of those who went to see Mr. Werdermann's light. It was divided into ten lights, and each one was said to have 40-candle power, but, for his part, he could not compare it to anything more than a good-sized rushlight. The room could not have been more than 30 feet by 12 or 13 feet, and yet the light was not so glaring as to prevent some young ladies and gentlemen, in a corner, carrying on a *tete-a tete* in perfect shade. When he was told the number of candles this light represented, it was to him a very astonishing fact. One of the most experienced men in the gas world was with him, and he agreed with him on this point; in fact one could hardly see what color the walls of the room were, and he thought there must be several kinds of photometry, one for gas lights and another for electricity. He should like to ask if any one knew whether Sir William Thompson had published his plans of how he was going to put the water wheel over Niagara to light up the northern part of America, because that was the sort of thing that was talked about, and he thought perhaps the plans might be out, and some one might have seen them.

The Secretary drew attention to some interesting experiments recently made at Rheims by the Engineer and manager of the gas company, and published by the Society Technique de l'Industrie du Gaz en France, with regard to the great loss of illuminating power by division of the electric current. He said that reckoning the illuminating power of the naked voltaic arc from a Serrin regulator at 290 Carcel lamps, it was found that by the interposition of an opal globe, there was a loss of 92 Carcels, or 31·72 per cent.; by the use of one of Regnier's lamps the loss was 132 Carcels, or 45·51 per cent.; by the interposition of four lamps the light ceased entirely. He (the Secretary) commended the attention of gas engineers to these experiments, which were most elaborate, and appeared to have been made with the greatest care. They embraced many trials with the view of ascertaining the illuminating power of both the electric light and various kinds of powerful gas burners, and an examinrtion of them would well repay the time spent in the perusal of the report.

Mr. D. Bruce Peebles (Edinburgh) said it was very evident from the paper just read that the case between gas and electricity would be well fought out, and that if it ever came to such a pass as that the one was fighting against the other for a bare existence, gas would at any rate die game. He believed that so long as a plentiful supply of coal was to be had, gas would easily hold its own; but, at the same time, no good warrior ever under-rated the power of his enemy, and they should freely admit that electric lighting had made some rapid strides lately. While, therefore, it was quite evident that, in the present state of affairs, gas had entirely the upper hand, they did not know what a day might bring forth, or how soon electricity might go forward with a bound. No one who had read the life of George Stephenson could help remembering the answer he gave to a question when giving evidence about railway matters before Parliament: "Supposing a train, going at this extraordinary rate of 20 miles an hour you speak of, was to come against a cow, would not that be very bad?" He replied, "Aye, very bad for the coo." Now 50 and 60 miles an hour are run at the present day, and little thought of it. It was not impossible, but rather very probable, that electric lighting might make quite as great a stride forward, and they should never lose sight of such a possibility, but rather try and be prepared to meet it. A few days ago he received a newspaper from New York, by which he saw that the American gas engineers were taking that view, and had started a society for the purpose of considering what would be the best means of upholding the power of gas against electricity. It was quite apart from the American Gas Light Association, and its objects seemed to be entirely limited to fighting this battle (if it might be so called) of gas against electricity, not altogether in an unfriendly spirit, but by acknowledging that electric lighting was no longer a thing of the past, and must be met by employing the best methods and most economical processes of manufacturing gas, so that they might be able to meet electricity on all points where it would be likely to encroach on the field now occupied by gas. His own opinion, he might again state, was that, so long as there was coal in abundance, there would be no fear for gas, for even if it were not used as an illuminant, it would be more and more used as a source of heat and motive power, and manufactured on account of the bye-products, which had now become so valuable in the arts and manufactures. In such a case their value would certainly increase, and, along with these, other sources of income might likely make the distillation of coal quite as profitable as it now was. He also understood that an English Electric Light Company had gone to New York, and was there working successfully against Mr. Edison. With regard to Sir William Thompson's opinion, it was whispered that he and Prof. Tait had been very much together for some time past, and it was thought Sir William must have discovered something new, which had enabled him lately to give such distinct and decided evidence regarding the electric light.

Mr. G. B. Irons (Gosport) said, as gas engineers, they knew that there was great loss of light by distribution through small instead of large burners. This they had seen in the large lights of Mr. Sugg as compared with the old ones—especially the little jets some would persist in using, particularly in churches. They knew that the amount of light was less when the lighting body was distributed in small quanties, whatever was the source of light. As to the question whether the loss by division of the electric light was in the proportion of the squares or cubes of the numbers, as stated by Mr. Preece in his evidence before the Commons Committee, it might very well be left to the more experienced electricians to determine; but the loss of light by division was a natural law they could not get over. As most of them had read, the new iron turret-ships in the Royal Navy were fitted with electric lights generated by Gramme or Holmes machines, driven by one of the many engines on board; and he was himself able to read when the light was nearly three miles off; but this was the concentrated and reflected light from a very powerful machine costing about £700. There was no question that the shadows thrown by old-fashioned street lamps were very objectionable, and when such lamps were introduced into a new district, many coachmen had said they would rather be without the light at all, because the shadows thrown across the road were confusing to them, and they could hardly pick their way.

Mr. J. Paterson (Warrington) desired to express his thanks to Mr. Sugg for the very able, comprehensive, and exhaustive paper he had read. It was one more fit for study than for commenting upon without consideration; but it appeared evident that, light for light, gas had nothing to fear from its competition with electricity, and he thought the supporters and exponents of the electric light did injustice to themselves in placing it in such a position as to compete with coal gas. There were, no doubt, many ways in which the electric light might be made exceedingly valuable, apart altogether from any competition with gas, and it was quite possible that the time might come when, by a more perfect system and adaptation of means to ends, its relative value might be improved; but so long as the electric light was obtained by the conversion of mechanical energy into electricity and light, it could never be an economical mode of illumination. There were, however, other elements which were very much against its permanent introduction as a constant light; for example, the rapid destruction of the carbon electrodes. So long as the electric light depended on these charcoal points, it was really impossible to have a steady, constant light. He thought there was no doubt that the amount of light was reduced in a geometrical ratio by the division of the current. Practically, to all intents and purposes, this fact destroyed the power of utilizing the light, because, although it might be done, it could not be done profitably, and no human agency could overthrow the laws of nature. But while acknowledging this fact, it should not be the wish of gas managers to disparage or in any way detract from the merits of the electric light, which had already done good service to the profession by stimulating to improved methods in the combustion of gas.

Mr. Woodall (Leeds) said although gas had nothing to fear from the competition of electricity, still it behoved them all to see how gas could be improved. It seemed to him very plain that it would be to their advantage to offer some inducement to local authorities to increase the quantity of gas consumed in their lamps. They all knew that if they had more gas to make they could make it more cheaply, and therefore he should be disposed to offer public authorities, in consideration of their increasing the quantity of gas consumed, that for the increased quantity a reduced price should be charged. If they could increase the quantity of gas made by 100 per cent., the amount required to pay interest on capital would be considerably reduced. Supposing it now costs 1s. per 1,000 feet to pay dividend, the increase in works that would make double the quantity would not cost, generally speaking. much over 6d. per 1,000 feet, so that it would be to their advantage to make a reduction by anticipation. It was a difficult thing, he could see, to charge different rates to different consumers; but between public authorities and the general public, a very distinct line could be drawn, and it would be very simple to make contracts with the authorities that for a certain consumption the price should be so much, but if it were below that amount the price should be the same as that charged to private consumers.

Mr. J. R. Frith (Runcorn) said they had had two lectures on the electric light at Runcorn, and for one of these he obtained a Wigham and a Sugg burner, and after the lecture every one was convinced that gas would be superior. He had these burners carefully tested, and he could bear out Mr. King's statement in the *Journal of Gas Lighting*, of April 22, that the Sugg burner, with the three concentric rings, gave an illuminating power of nearly 5·2 candles per cubic foot. He had also one of Wigham's burners purporting to give 400-candle light; but on trying it he found it would only give a light of a little under 4 candles per cubic foot, so that really the Sugg burner had the advantage over it by more than one candle per cubic foot. They were indebted to Mr. Sugg for the great interest he had taken in this question. He had been there champion in this cause, and had rendered valuable service to the whole of the gas world.

Mr. W. Romans (Sheffield) said they had at Sheffield tried the electric light, and now they were trying Mr. Sugg's burners. With these they could read a newspaper midway between the lamps; but with the electric light they could not read at all—he could not read his own name on his card. The very cabmen could not see their horse's heads. He hoped the Corporation of Sheffield would decide on adopting the Sugg burners.

Mr. Corbet Woodall (London) thought the time had really come when the figures as to the cost and value of the electric light given by its promoters ought to be answered, and therefore he sympathised in that direction with the character of Mr. Sugg's paper. At the same time he thought it would be wise to abstain from sneering at the electric light. The progress made with it was eminently creditable to those who were working at it, and there was room doubtless for considerable application of it without the smallest loss to gas companies. The trial on the Thames Embankment had shown that with good apparatus in careful hands the electric light could be made a practical light, and the question of its application in such situations was reduced to one of labor and cost. While there had been a large number of extinctions in the streets of Paris, he believed that, during the many months that the lights had now been burning on the Thames Embankment, there had been but one extinction. In many ways they were indebted to the interest which had been excited by the electric light. He had not one particle of fear as to its injuring the gas interest, for he felt convinced that both in the matter of adaptability and of cost there was no fear of its entering into serious competition. That feeling was based upon these facts: Nothing whatever had been done which elevated it out of the category of lamps requiring the attention of the consumer, and needing serious and frequent attention. That being so, there was a decided difference between it and gas lighting, which no question, even of economy, could absolutely overcome. Again, there had been found no way of producing light of less than 200 or 300 candles power, except at vastly increased cost, and, consequently, the number of its applications was limited. Further, there could be no reserve of light at once available, as was the case with gas; and the light for ordinary purposes was a most unpleasant one even when momentarily steady. As to street lighting, he owed some gratitude to Mr. Sugg for upholding his (Mr. Woodall's) reputation as a prophet. He remembered last year saying that if the public authorities would agree that it was desirable to increase the amount of illumination, they (the gas managers) had only to turn to Mr. Sugg, and he would bring out yet another burner which would do all that was required. His own experience in this matter was entirely satisfactory. After witnessing what had been done in Paris, he suggested to his directors that it would be the right thing to show what could be done with gas, if people were prepared to spend the necessary money. Accordingly they lighted, by means of improved lamps, a strip of road in their district very well indeed, and the result had been that to a large extent the new system had been adopted by the Vestries. That example had since been copied by many neighboring parishes, and generally it had resulted in a large increase in rental of the company. He thought it was very doubtful whether it was economical to use large burners at considerable distances, instead of small burners close together. In the Waterloo Road he put up lamps at frequent intervals, abolishing the objectionable basket which caused the shadows, adding reflecting tops, and increased the consumption of gas to 6 instead of 5 feet per hour. The general effect of the light was exceedingly pretty, effective and cheap. When they remembered the ordinary charge made for gas lighting, it would be seen that there was room for a considerable increase in the expenditure, and yet keep far within anything the electric light could do. For instance, in that particular road, the lighting was effected at a cost of under 20d. per mile per hour, including gas, lighting, repairs, and maintenance. Contrasting that with the electric light, it would be seen what a very large margin there was for increased expenditure, if it was called for. He entirely agreed with Mr. Hartley, however, that the ratepayers would not stand the increased cost involved by some of the systems which had been shown. He believed the lighting of the streets generally was sufficient at the present time. In great thoroughfares, where there was much traffic, it was most desirable largely to increase it, especially at centres of traffic; but as far as the general illumination of the streets was concerned, he thought it was at present sufficient, and any large increase in the rates of a town or parish, called for in order to increase largely the general lighting, would be met with strenuous opposition.

Mr. Sugg, in reply, said his paper had been so kindly received that there was very little he need refer to, except the remark of Mr. Woodall as to the cost. If the public bodies would not spend any more money in lighting the streets than they now did, it was perfectly clear that they would not have anything to do with electricity. He had addressed himself to what could be done by gas as compared with electricity; but if the public were determined they would not spend any more money, there was an end of it. What he had also pointed out was that, even with the number of

feet of gas at present consumed, it would be possible to give more light by the use of improved burners, and more effective illumination by abolishing the shadows. He was quite sure, however, that there would eventually be an increase in the consumption of gas in the public streets. Of course, it would not come all at once; no public improvement ever did. First the crossings would be improved, and then other places would by degrees receive attention.

[The other papers read will follow in due course.]

Gas Companies and Consumers.

For several weeks a discussion has been going on in the *English Mechanic* on the question as to whether pressure affects the consumers' accounts. Writing on the subject, Mr. J. R. Warren says:

From the tone of "Loftonian's" last letter I am led to infer that he objects to reduce his pressure by the main tap, on the assumption that the pressure being reduced before the gas enters the meter, the gas expands and is increased in volume by the reduction of the pressure, so causing the meter to register in favor of the gas company. I do not say that this is not the case, but I will endeavor to show him the increase in volume is so very small that his gas bills cannot be effected thereby.

It is a well-known fact that the volume of gas is inversely proportional to the pressure to which it is subjected. If we increase the pressure the volume is diminished, and by diminishing the pressure the volume is increased. If we take a volume of gas measuring, say, 100 cubic feet—the pressure being equal to a column of mercury 30 inches high—then, according to the above law, if the pressure is reduced to 29 inches, the volume will be increased to 103·4 cubic feet. I need scarcely inform "Loftonian" that to distribute gas it must be subjected to a pressure greater than that of the external atmosphere, or it would not flow through the pipes and escape through the burners for combustion. This pressure to which the gas is subjected is measured by the height it will support in a column of water, expressed in 1-10ths of an inch. And in correcting the volume of gas for pressure, this pressure should be reduced to its equivalent height in mercury and added to the pressure given by the height of the barometer. Mercury is 13·5 times heavier than water; therefore, a column of water 1-10th of an inch high is equal to a column of mercury 0·00741 inch in height. We will now assume "Loftonian" to have his main tap turned full on, and that the pressure at the inlet of his meter is 15-10ths, the pressure to be regulated anywhere he thinks proper, beyond the outlet of his meter, to 5-10ths, and that his meter has indicated a volume of gas equal to, say, 1,000 cubic feet. We will now suppose he takes the advice given by the gas men, and reduces the pressure at the inlet of his meter, by means of the main tap, to 5-10ths, all the burner taps in use to be full open. His gas is now passing through the meter at a pressure equal to 10-10ths less than it was in the first instance, which will cause the gas to expand, and to have increased in volume to x cubic feet, which, of course, his meter will indicate. We can easily find the value of x by the law given above—taking the barometer as standing at 30 inches—as follows:

$$(30+5\text{-}10\text{ths}) = 30{\cdot}03705 : (30+15\text{-}10\text{ths})\ 33{\cdot}11115$$
$$:: 1{,}000 : x.$$
$$\therefore x = \frac{30{\cdot}11115 \times 1{,}000}{30{\cdot}03705} = 1{,}002{\cdot}46$$

"Loftonian" will thus see that by taking the advice of the gas-men his meter will have registered 1,002·46 cubic feet, which is .0246 per cent. in favor of the gas company; but I think he will agree with me that this is not buying his elastic so very much on the stretch after all, and that his accounts will not suffer to so great an extent as he imagines by taking their advice, especially when we take into consideration that the "Sales of Gas Act" allows a meter to be stamped as correct with a range of 5 per cent. in its registration, namely, 3 per cent. slow and 2 per cent. fast. We also see from the above that, practically, it does not signify whether the pressure is reduced before the gas enters the meter or after it has left it. It is best to use a governor for the purpose of regulation, because the governor, being self-acting, requires no attention. Where a governor is not used I should advise the regulation to be made by tap fixed anywhere on the main supply. I always advised the regulation to be made by the main tap; it answers to perfection, and saves the expense of having an extra tap fixed elsewhere.

I think I have now said enough to convince "Loftonian" that he is in error in charging the gas-men with fraudulent intentions, the increase in the registration of the meter being too small to justify him in bringing such a grave charge as fraud against them, and I think he will see, from the experiments I made, that consumers would gain largely by taking their advice. I have adopted the same pressure I used in my previous reply, because I consider 15-10ths to be a more than sufficient maximum pressure to be given by any gas company at their consumers' meters, and for the minimum of 5-10ths, because it is the standard pressure used under the "Sales of Gas Act" for testing meters, and, further, it is the least pressure that can be used with economy for illuminating purposes where common burners are used.—*Journal of Artificial Light and Sanitary Gazette.*

Coal Gas versus Water Gas.

The recent gas controversy has brought to mind many important matters connected with its consumption and relative cheapness, as compared with other illuminating substances, as well as its safety under its several forms of manufacture.

With a view of determining the position that the gas companies occupy, with regard to the general public, we propose to show, in brief, the nature of the claims set forth by the water gas companies with respect to the wonderful illuminating power claimed for the substance distilled from hard coal, and petroleum or the products of the latter.

In a circular recently issued by one of the companies organized under a patent having in view the manufacture of gas by such means, it is boldly set forth that their gas has very much greater illuminating or candle power than gas manufactured by the ordinary process from bituminous coal, and that by their method a saving was effected to the consumer of from 25 to 50 per cent.

This is truly a wonderful discovery. It calls to mind the anecdote of the miserly farmer who, after repeated experiments, thought he had hit upon a plan for keeping his stock in good condition at a very small cost. He tried the experiment first upon a favorite white horse. This animal was fed upon nothing but bean straw for several days without any apparent loss of strength. The farmer was in high glee over the experiment, and invited his neighbors to come and view the result. The barnyard was sought out by the assemblage, when lo, and behold! old White was found in a far-off corner stiff and dead.

"How is this?" asked the farmer of Dick, the hired man, as he turned his eyes up with amazed sorrow at his loss.

"Don't know," said Dick, "but I gave him all the bean straw he would eat."

"Aye, I see," said the farmer, with a sigh and a moan, "you must be more careful next time, you fed him altogether too bountifully!"

It only requires one more discovery—patented, of course—on the part of the water gas companies to save the lucky consumer the remaining 50 per cent., and his gas bill would be wiped out altogether.

But what are the facts? Take, for instance, the Manhattan gas at a relative standard of 100, flowing through a four foot burner, and the Municipal at a standard of 75, passing through the same-sized burner, the average candle power is 16 for the former, and 22 is claimed for the latter, bnt allowing for the difference in gravity and actual illuminating radius and the Municipal gas is actually only about an average of 12 candle power. The tests being in every case equal, the result must prove substantially correct.

The apparent difference that the water gas company's claim arises from the different-sized burner, less volume of consumption, greater impurities in the shape of negative illuminant properties, and a marked difference in specific gravity as compared with coal gas. For instance, coal gas containing six per cent. of illuminants will furnish 16 candle power, while water gas with 18 per cent. of illuminants, will give only 22 candles, showing that it requires 200 per cent. increase of illuminants for 87 per cent. increase of light.

All the rest of what should prove beneficial is negatived by the large proportion of carbonic oxide and other impurities, which enters into the elements of its production. These non-illuminants are absorbents as is indicated by a pale blue flame.

An actual loss of about 20 per cent. takes place in bringing water gas to a good standard of excellence. Gas made from bituminous coal contains about five per cent. of carbonic oxide, while water gas contains, by analysis, from 26 to 36 per cent.

If this statement is true, as is vouched for by eminent chemists, the question of illuminating power is not the only one to be considered. It has repeatedly been ascertained that about five-tenths per cent. of this poison will kill birds and small animals, while its presence in slightly increased quantities is likely to prove very injurious to human health, and even destructive to life.

This is especially very likely to happen with persons of weak habit, and those liable to affections of the heart, or laboring under pulmonary difficulties and affections of the throat and air passages.

Water gas is no new thing; patents for its mannfacture date back to 1810, and it has at various times been introduced both in Europe and America, but generally with doubtful success. Selligue obtained permission, in 1840, to use the gas in the towns of Dijon, Strasburg, Antwerp, and also in Paris and Lyons.

At Strasburg an accident occurred which put a stop to its use. The gas

escaped from the pipes in a baker's shop and was fatal to several persons, while similar accidents resulted elsewhere, since which its use has been interdicted on the Continent. The utmost caution should be exercised to make all descriptions of illuminating gas pure, and nothing should be left to chance or ignorance.

Whether we use coal gas or water gas, the duty of the consumer is plain. Investigate and consider the claims put forth by all sides and you will be better able to judge the merits of the gas controversy in its plain and common sense view.

There is no need to derive any assistance from *inflated circulars* that are only intended for special localities and unreflecting readers. The matter can be determined quite satisfactorily by ordinary observation within the scope of your own business or household pursuits.—*New York Trade Reporter.*

On the Smoke of an Electric Lamp.

BY B. S. PROCTOR.

At our meeting in December, 1878, Mr. J. W. Swan exhibited an electric lamp, on the incandescence principle, which had broken down in consequence of the electric force being too great for the cylinder of carbon through which it had to pass. A note on this subject appears in the current part of our *Transactions*, p. 190. One of the points of interest noted was the appearance of a sooty deposit on the inside of the glass. The flask which contained the carbon pencil and its platinum conductors, having been filled with nitrogen and exhausted with a Sprengel pump, was supposed to contain nothing which could act as a carrier to convey by chemical means any carbon from the incandescent pencil to the cooler surfaces in its neighborhood. The phenomenon appeared to be such as have been spoken of under the term "volatilisation of carbon." Mr. Swan having placed the lamp at my disposal for examination, I have now the pleasure of bringing under your notice the results.

Under the microscope the smoky deposit on the glass showed numerous bright globules, no doubt platinum, and more minute particles of dark matter, nebulous under a ½-inch objective.

A fragment of the glass exposed to an oxidising heat, the deposit partially disappeared, still leaving the glass slightly darkened.

The platinum support—which had also a coating of dark sublimate at a little distance above and below the carbon pencil, but not in immediate juxtaposition with it—was next examined by exposing to the blowpipe flame the unsmoked portion, so that the conducted heat might act upon the deposit without the fear of the blast carrying away the matter, which was very loosely attached. In this way the deposit was burnt off without the mechanical action of the blast, the heat to which it had been subjected being that of dull redness.

A piece of the glass was then treated with aquia regia for several days. The deposit was diminished, but far from being entirely dissolved; the solution gave a blue reaction with yellow prussiate of potash, and no coloration with tannin till aided by vapor of carbonate of ammonia, when the usual purple color of ferric tannate was developed. There is thus evidence of the deposit containing platinum, carbon, and iron. Probably the scattering of platinum globules might result from the disruptive discharge which took place at the moment of the lamp breaking down.—*Chemical News* June 27.

ROME (GA.) GAS LIGHT CO.—On the 1st day of January last Col. C. G. Samuel, of Rome, purchased the Rome Gas Light Company's franchise and the entire property. He has paid up every debt due by the old Company, and issued 7 per cent. (20 years) bonds to the amount of $15,000, interest payable on the 1st of January and July of each year. The cupons due July 1st were promptly paid at the office of the Company, and these bonds are now worth par in the market. We congratulate the new management. A new holder is being erected to supply the increased consumption of gas.

THE ACTS OF PARLIAMENT which regulate testing for illuminating power in London, state in express terms that the light given by the gas is to be that of so many sperm candles of six to the pound; and we remember well, when Mr. Forster's Committee was at work in 1875, this question of the mode of testing was noticed, and they refused to make any change either in the substance or wording of the acts. It happened in this way: Mr. W. Pole, one of the gas referees, was engaged to watch the proceedings of or before the Committee, and when the clause in question was arrived at, he went to the chairman and suggested a change in the wording of the act. In lieu of "the light of 16 candles," he proposed that it should be "a light *equivalent* to that of 16 candles," so as to allow, if desired, the use of some other apparatus than the candles, as hitherto. At that time a lamp, Mr. Keates' or some other, was what was contemplated in lieu of candles; but of course, had the terms of the act been so changed, it would have allowed of Mr. Harcourt's new process being adopted, or any other. But the fact is that the alteration proposed by Mr. Pole was decisively rejected. It was opposed by Mr. Cripps, on the part of the Corporation of London, and we repeat was at once rejected by Mr. Forster and the Committee. This is a fact worth remembering.—*Gas Trade Circular and Review.*

Progress of the Generator Furnace System in 1878.*

Wagner's Jahresbericht der chemischen Technologie, recently published (an annual review of the progress in the field of applied chemistry), contains the following paragraphs relative to generator furnaces, which may prove interesting to our readers:

During the past year Dr. Bunte, of Munich, communicated some very valuable information in regard to generators, their gases and their applications (*Journal fuer Gasbeleuchtung*, 1878, pp. 62–71 and 386), and he endeavored to determine, by way of calculation, the economic efficiency of a generator plant, basing it upon the determination of the volume and of the chemical composition of the effluent products of combustion, and upon the known composition of the fuel which was employed.

Dr. Bunte (*Journal fur Gasbeleuchtung*, 1878, p. 90) also discussed the various circumstances in connection with the production of heating gas by means of a generator filled with coke and supplied with air and steam, basing himself both upon calculation and experiment. It would appear that air and steam must enter the generator in such proportions that the heat which is developed by combustion of the former be sufficient to decompose into carbonic oxide and hydrogen gases the steam which enters at the same time. This proportion, and with it the composition of the generator gases, will vary according as the air combines with the carbon to form carbonic oxide or carbonic acid, and the author gives the computations for the results of combustion as follows:

A.—*With Dry Air Only.*		B.—*With Steam Supply of* 200°*C.*			
		1. Carbonic oxide.		2. Carbonic acid.	
Hydrogen	0.0	6.36	43.02	17.84	35.60
Carbonic oxide....	34.71	36.66		17.84	
Carbonic acid.....	0.0	0.0		13.51	64.32
Nitrogen	65.29	56.98		50.81	

Theoretically the temperatures of the effluent products of combustion would be as follows:

In the case of A=1,485°C; B_1=1,000°; B_2=1,000°.

Now, since equal volumes of hydrogen and carbonic oxide develop during combustion nearly equally many heat units, the calorific value of the generator gases will mainly depend upon their quantities; it is greater in the case of B_1 and B_2 than in that of A, but the temperatures are considerably lower in B_1 and B_2 than in A. In the opinion of the author, therefore, the advantage of employing steam in the generation of heating gas would lie essentially in the fact that it prevents an excess of heat in the generator, and, therefore, much loss of heat by conduction and radiation, while it retards the formation of slag. The percentage of water vapor in the air supply, however, may vary, it would appear, between rather wide limits without causing any seriously disturbing influence upon the working of the generator, and its amount regulates itself when the evaporation of the water is allowed to take place in the ash-pan directly under the fuel. In conclusion, the author compares his values for the composition of generator gases, as determined by calculation, with those found by analysis by Ebelmen in 1843 (Annales des Mines (2) III., p. 223) and by Grahn in 1877 (Journal fuer Gasbeleuchtung, 1877, p. 586) with which they agree in a very satisfactory manner.

Schiele (Wochenschrift d. Vereines deutcher Ingenieure, 1878, p. 181) discussed the principles which are involved in the construction of gas generators. He laid particular stress upon the desirability of constructing the generator without any grate bars, if possible, and merely with one slit. The stepped grate is particularly objectionable, owing to the very appreciable outward radiation of the heat; this objection, however, has recently been pretty thoroughly removed by blowing in air and steam by means of a Korting injector, whereby the formation of slag is also diminished. The slit generator, however, is said to give most satisfaction. In working, it is most advantageous to employ a slight draught of, say, .2 to .3 inches water pressure. The outlet orifices for air and gas are of especial importance: they must allow, at the same time, of an intimate mingling and certain regulating of the two currents. The system of regulation devised by M. Grahn, it is believed, gives the best satisfaction.

The author then laid stress upon the necessity of gasometric analyses of the generator gases, as enabling a thorough control of the process of combustion, and draws attention to the fact that in recent experimental researches on generator gases the Kestner apparatus for indicating draught invariably recorded a pressure, which must be maintained by locating the generator plant at the lowest possible point. For firing steam boilers the generators constructed by MM. Muller and Fichet have thus far been most successful. In this construction the furnace or combustion chamber of the boiler is lined with fire-brick, both for the protection of the iron from the action of the flame, and in order to prevent any sudden cooling of the gaseous mixture. It was also stated that a system originating at Aix-la-Chapelle, in Prussia, would seem even more promising. Here the generator is located

*Translated for the AMERICAN GAS LIGHT JOURNAL by A. P. Trautwein.

directly in front of the boiler, and the air meets the gas upon all sides. The author also mentioned a generator constructed by MM. Graebe and Luerman (Wagner's Jahresbericht, 1877, p. 1128), and remarks that one serious objection to it lies in the use of a screw which serves to push forward the contents of the coking retort.

M. Perret (Les Mondes, vol 45, p. 193) published a description of a generator of comparatively easy construction, which admits of the combustion of slack or dust coal, coke breeze—in short, of refuse fuel of every kind, even of peat The furnace consists essentially of four fire-brick chambers, slightly arched, arranged in tiers one above the other, and communicating with one another. The columns or piers supporting them are of fire-brick also, and constitute the side walls of the hearth. The face wall is hollow, is constructed of cast iron, and serves to warm the supply of air to the furnace, which, previous to entering the closed ash-pit, passes through this space; access to the chambers is secured by three doors in the face wall, one above the other. In order to provide against loss of heat, the entire generator is surrounded by massive brick walls. It is put into action by firing with wood and coal, spread uniformly and in thin layers in the several chambers, combustion being maintained by the air which rises from the ash-pit, and passes to and fro in the several tiers. When the brickwork is red-hot it is ready for the reception and thorough combustion of even the poorest of fuels. The charge is uniformly spread in the upper chamber, and is consumed, unlike in the ordinary system, from the upper surface downward, and thus passes down from chamber to chamber until finally, when completely exhausted, it is found in the ash-pit, its place being supplied at the same rate by fresh charges from above. The products of combustion leave at the upper chamber. The operation of charging, including cleaning the ash-pit, occupies from 15 to 30 minutes. The intervals between the charges vary from 6 hours under forced working to 12 and 24 hours under average and slow rates respectively. Too strong a draught cools the lower chamber, too slight a draught the upper; this behavior is a ready and sure criterion of the proper air supply. At intervals of charging of four hours, the consumption of coal is .44 pound, exclusive of ash, per square foot per hour.

Albert Putsch (Chemische Industrie, 1878, p. 247) suggests a system of regenerative furnaces, which, it is claimed, will make the regenerative principle applicable on a small scale also. The new furnace, in the opinion of experts, is said to merit close attention.

M. Liegel, engineer of the gas works at Stralsund, patented a system of generator furnaces which is particularly adapted for industrial purposes, necessitating a continuous working, *i. e.*, both day and night. It is applicable and valuable in the case of retort ovens, melting and welding furnaces, etc.,—in fact, whenever intense heat is required, and equally so when the purpose is merely to evaporate, as in the case of sugar pans, steam boilers, etc. Coke, coal, and tar may be used as fuel. The following are the essential characteristics of the system:

First. The grouping together of 9, 10, and 11 retorts in one oven and directly above one furnace.

Second. The peculiar form of the generator, which is funnel-shaped, having no smooth walls, all being stepped. At its lower extremity it ends in a long, narrow slit, which serves as a grate, and thus displaces the ordinary grate bars. The air supply, no matter what course it may take, is compelled to pass through or come into contact with incandescent fuel, and does not pass unconsumed along vertical, straight walls.

Third. The auxiliary grate which catches the particles of fuel passing through the slit, as well as the slag which flows down. The small auxiliary fire, which is thus formed, serves the purpose of preventing the slag, when not readily fluid, from chilling in the slit, and of inducing its voluntary removal.

Fourth. The air passages, which are located in the right and left sides of the grate. By this arrangement cool currents of air pass along the sides of the slit blocks, through the slit, and thus prevent their melting down.

Fifth. The arrangement when using tar as fuel, in which the great distance between the hearth and the object to be heated enables a thorough combustion of the vapors before they are utilized.

Gasoline Lamps in Boston.

The city of Boston has decided to abandon for the present its experiments with gasoline lamps, and the committee on lamps, of which Hugh O'Brien is chairman, directed the companies that put them in on sixty days' trial to remove them. There is no explanation of this decision, nor any intimation to the companies directly interested in the success of the scheme that they have not done their work as it was represented they would. The United States Company put up 82 on the Common and 77 at Roxbury, while the Globe Company put 82 on the Common and 62 on the avenues toward Brookline, the former beginning to light June 5 and the latter May 28. The total expense for light and care was to be $20 a lamp per annum, as against $34.56 per annum, the total cost to the city for its street gas lights. The change will be effected before August 1.

Those who have been in any way dependent upon the gasoline street lights, which are to be removed, will receive the announcement with approval. The unpleasant odor which they give out, and which fills the air to a considerable distance, particularly when there is is a wind, is the least of the objections to them. They furnish a light which can be seen if it is steadily looked at, but they do not illuminate the streets and walks. If no more light than they give out is desired, the object can be accomplished by diminishing the consuming capacity of the gas burners. But we suppose that is not the idea. In other cities, particularly in London, experiments have been made with a view to the better lighting of the streets, and it has been found that by using burners of greater capacity a much more intense light can be obtained, of course at a greater, but not a correspondingly greater, cost. Here our experiments have been in the opposite direction, and the result is unsatisfactory. The glimmer of the gasoline lights has not proved to be suited to the purpose of street lighting.—*Boston Advertiser*, July 24.

Reduction in Price of Gas.

METROPOLITAN GAS LIGHT CO., BROADWAY COR. 46TH ST.,
NEW YORK, July 16th, 1879.

From the 1st inst. the rates of this Company will be, for those using less than 5,000 cubic feet per month, $1.90 per thousand cubic feet.

5,000 to 10,000	"	"	1.85	"	"
10,000 to 20,000	"	"	1.75	"	"
20,000 to 30,000	"	"	1.65	"	"
30,000 to 40,000	"	"	1.55	"	"
40,000 to 50,000	"	"	1.45	"	"
50,000 to 70,000	"	"	1.40	"	"
70,000 to 85,000	"	"	1.35	"	"
85,000 to 100,000	"	"	1.30	"	"
100,000 to 150,000	"	"	1.25	"	"
150,000 and upward	"	"	1.00	"	"

We constantly take advantage of and adopt every improvement in the manufacture of gas, and endeavor to furnish a superior light, which shall at the same time be pure and safe to the consumer. We also draw attention to the utility of gas at the above rates for heating, cooking, etc. No smoke! No coal! No ashes! No dust! And less help required. With gas the consumption of the fuel continues only while in actual use, and during summer this adds greatly to comfort, without speaking of the economy.

Where any trouble is experienced with the light we would request our dealers to inform us of the same, and prompt attention will be paid to the matter.

We require of our employees to be civil and polite at all times, and would feel obliged if informed of anything to the contrary. Respectfully,

O. ZOLLIKOFFER, *Prest.*

Richmond County (N. Y.) Gas Light Company.

The Richmond County Gas Light Company held its annual meeting at Clifton, July 16, and elected W. H. J. Bodine, J. Hull Browning, C. C. Eddy, Frederick E. Mather, Edward A. Roome, Francis G. Shaw, Henry M. Taber, Geo. A. Thorne, and Henry D. Townsend, Directors. On July 22 the directors organized as a board by re-electing Mr. Mather President, and Mr. Eddy Secretary and Treasurer.

From their report for the year ending with June, 1879, it appears that they carbonized 1,817 tons of coal, viz., 2 per cent. Ince Hall, 19 per cent. Murphy Run, and 79 per cent. Youghiogheny. They used 3,420 bushels of shell lime. Of gas, they produced 20,273,000 cubic feet. This shows a yield of 4.98 per pound, and 5,928 per bushel.

Nearly 27 per cent. of the gas they sent out was chargeable to public lamps, condensation, and leakage. No more requisite information is given as to the per cent. actually lost.

Prompted by the requirements of the day, they are practicing economy at all points, reducing the price of gas to the lowest living rate, and content with small gains.

GLASGOW GAS AND WATER SUPPLY.—From the annual report for 1878 of the Glasgow City Chamberlain (Mr. W. W. Watson) just issued, it appears that during that year 1,777,846,000 cubic feet of gas were produced, while the quantity sold and accounted for was only 1,481,329 cubic feet, showing a difference of 296,517,000, or 16.67 per cent. of the total quantity made. The production of the year was about 40 million cubic feet under that of 1877, but it has doubled within the last 15 years. About 30 million gallons of water were drawn from Loch Katrine, and 4 millions from the Gorbals reservoir daily, on an average, during the year.

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SATURDAY, AUGUST 2, 1879.

Official Report of Examinations of Gas for two Weeks ending July 26, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

July 1879.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
14	Between 9.30 A.M. and 1 P.M.	16.14	17.36	18.05	17.96	15.91	
15		16.09	17.15	17.75	19.65	16.60	
16		15.98	16.62	17.66	18.43	16.42	
17		16.31	17.24	17.45	17.47	16.16	
18		16.34	16.92	17.03	16.74	16.00	
19		16.51	17.12	17.52	16.80	16.29	
	Average	16.23	17.06	17.57	17.84	16.23	
22		16.45	16.95	18.50	17.67	16.46	
23		16.63	17.05	18.44	17.54	16.44	
24		16.48	17.02	17.82	17.47	16.52	
25		16.49	16.92	18.05	17.37	16.20	
26		16.45	16.81	18.22	16.59	15.35	
	Average	16.50	16.95	18.20	17.33	16.19	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

The Fastest Passage on Record.—The new steamer Arizona, which passed Sandy Hook, at half-past five, June 17, arrived at Queenstown at twenty minutes past seven the morning of June 25. The actual running time was 7 days 9 hours and 23 minutes, the fastest transatlantic trip on record. This is one and a half hours less than the time of the Britannic, in August, 1877.—*Iron Age.*

Connecticut Gas Engineers' Association.

A meeting of the gas engineers of Connecticut was held on Tuesday, July 8, in New Haven, Conn., at the office of Mr. F. S. Sherman, engineer New Haven Gas Light Company, to consider the advisability of organizing an association.

After considerable discussion it was voted unanimously that an association be formed. A constitution was presented and adopted, and the following officers were elected:

John P. Harbison, President.
F. C. Sherman, Vice-President.
Charles H. Nettleton, Secretary and Treasurer.

All present were well pleased that an organization had been perfected, and were confident that it would result in being a great benefit to the members and the companies they represented. After the adjournment of the meeting the members were shown around the gas works by Mr. Sherman.

Quarterly meetings will be held hereafter at the various works in the State on the third Wednesday in March, June, September, and December.

CHARLES H. NETTLETON,
Secretary.

Gas Matters in Baltimore.

CONSUMERS' GAS COMPANY.

The second annual meeting of the Consumers' Mutual Gas Light Company, of Baltimore, was held at the office of the Company on South street. Officers were re-elected, including John W. Hall, Pres.; James A. Gary, Vice-Pres.; L. R. Smoot, Sec.; Jos. W. Clarke, Treas.; Robt. D. Morrison, Counselor; and the old Board of Directors.

The reports showed the receipts for the year to be $209,060.29; disbursements, $190,240.04, including interest on bonds, cost of new mains and the improvements at the works, etc. The Company has 4,925 customers for gas, an increase of over 600 for the year; and 16,000,000 cubic feet of gas were consumed. Six miles of new mains were laid, making a total of 59 miles. The new works for coal gas at Canton are to be completed by September 1, when the Company can make gas by both the Lowe (or water process) and coal. The engineer says he has no fear that the Lowe process will ever be unsatisfactory; that in the cold weather last winter not a lamp in the city was frozen. Gas by the Lowe process is made of naphtha, anthracite coal, and water steam. Last year the Company used 3,300 tons of anthracite coal, 550,000 gallons of naphtha or benzine, 20,000 bushels of lime and 8,000 bushels of sawdust, mixed, to purify the gas.

The engineer says that with the completion of the coal gas apparatus the company will have at its command the two best known processes for making gas.

Gas-Lit Buoys.

That the buoys which mark channels and wrecks are sometimes destroyed or displaced by vessels running along the coast on dark nights is well known. After two trials of lighted buoys, therefore, the Trinity Board has resolved upon sending a buoy, of which the lantern can be kept continuously burning, to a station off Dundee. The first of those trials took place in August last at the Trinity Wharf, when the light lasted uninterruptedly for twenty-eight days. Water was pumped upon it from a steam engine, to see what would be the effect of the shock and drenching, and no harm was done. The buoy was then sent down to the Nore, and there burned steadily for twenty-four days. The same buoy has now left London for its appointed place near Dundee. Provision has been made for keeping it alight without any interference for thirty-four days.

It is a buoy of most awkward construction, but this does not lessen its usefulness, and others are being more skilfully made to receive the same illuminating apparatus. This is a modification of what is known as Pintsch's compressed gas system, which was first brought out in Germany. It is proposed to make the buoy itself the recipient for containing the compressed gas, with its regulator (which is one of the most important points of the invention), and the lantern at the top of a short conducting tube. A buoy of ordinary size will burn about three months night and day, with only one filling, and the light is visible at a distance of about four miles. There is, however, in existence an electric lighting apparatus which might be employed, so that the light could be extinguished at sun rise and restored at sunset, giving, of course, a much longer duration to the working of the buoy. It will be interesting to see the result of this experiment, as the success of the scheme would be a boon to navigation.—*Pall Mall Gazette.*

The Holly System of Supplying Steam and Gas—Opposition in Lynn, Mass.

There was a public hearing before the mayor and aldermen last evening upon the petition of Wm. E Carlton and others for authority to open the streets of Lynn to lay pipes for conducting steam by the Holly system.

The new company gave notice that if its petition were granted they would furnish steam, for heat and power, and gas at $2.25 per thousand feet to the citizens, and $2 per thousand feet to the city.

The Hon. James N. Buffum spoke first, as representing the best interests of the city, in his opinion, and also the gas company. He thought that the signers to the petition for this new scheme had signed through misapprehension. He saw no occasion for the granting of such a privilege. The gas company was large enough now as a stock company, and he regarded it as very unwise to add a new company so long as the old one does its whole duty.

Mr. Chas. H. Hutchinson thought it incumbent upon the remonstrants to show cause why this privilege should not be granted, rather than that the petitioners be obliged to present their case. If there were citizens who desired to invest their capital in this matter, the privilege asked should be granted them.

Mr. Holly, of Lockport, New York, read to the meeting the report of Gen. Haupt, an engineer, upon the result of his examination of the Holly system for the transmission of steam and gas through pipes. He then gave the result of the practical working of this method of transmitting steam for power and heating purposes in Detroit, Mich., where ten miles of pipe are now laid and furnishing 800-horse power. The company is now introducing its system in Toledo, O., Rochester, N. Y., Dubuque, Iowa, and is now negotiating with New York City. The loss by condensation is averted by junction boxes placed at every 200 feet of pipe. The pipe has an external non conducting covering of hair felt, and is inclosed in a wooden box. The speaker claimed that in Springfield, Mass., the system was already paying 17 per cent. on its cost in the first six months of its use.

Mr. Buffum then called attention to the loss by condensation, claiming that the man did not live who could convey steam a mile without loss by condensation.

Mr. John W. Berry, regarded this as a matter affecting the interest of Lynn, and should be so considered regardless of the gas light company.

Mr. Buffum replied again in defence of the gas company, and explained the cause of the failure of the company to give good gas.

The meeting, as a whole, was in favor of the project. The Hon. James N. Buffum was left to bear the brunt for the remonstrants. The hearing closed at a late hour. The strongest argument of the opponents was the obstruction to the highway caused by opening the streets.—*Boston Advertiser*, July 22.

Canadian Railways.—The mileage of railways in actual operation in the Dominion of Canada at the close of the last fiscal year was 6,143 miles—about equal to the total railway mileage in the State of Pennsylvania, and some 1,200 miles less than that in

Illinois. In addition, track had been laid upon 721 miles, and 1,041 miles were under construction, making a total completed and being constructed of 7,905 miles, so that railway building has bee quite active in Canada during the last two years.—*Iron Age.*

Prices of Gas Coal.

Penn and Westmoreland.	$4.50	at New York.
" "	3.10	at Baltimore.
" "	3.75	at Philadelphia.
Despard, Newburgh Orrel, Fairmount	4.25	at New York.
	3.50	at Baltimore.
Chesapeake & Ohio	4.50	at New York.
" "		
Newcastle	3.25	to 3.50
Provincial	3.50	to 3.75
Cannelton Cannel (by cargo)	8.75	at New York.
Ince Hall	7.25	

The above prices are about $1 per ton below those of 1878.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)

24 Pine Street, New York City.

August 2, 1879.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid.	Asked.
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	75
Harlem	1,800,000	50	40	45
" Bonds	170,000			103
Manhattan	4,000,000	50	140	150
Metropolitan	2,500,000	100	110	115
" Scrip	$1,000,000	...	97	100
Mutual	5,000,000	100	50	55
" Bonds, gold	900,000	1000	100	105
Municipal	1,500,000	100	110	120
" Bonds	750,000		105	110
New York	4,000,000	100	85	90
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	115	125
Citizens	1,200,000	20	50	60
" S. F. Bonds.	320,000	1000	100	102
Peoples	1,000,000	10	20	30
" Bonds	325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	40	50
Nassau	1,000,000	25	55	65
" Ctfs.	700,000	1000	80	85
Williamsburgh	1,000,000	50	70	75
" Scrip		...	90	95
Kings Co	200,000	100	—	70
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	100	103
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	130
Cincinnati G. & C. Co.				190
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	120	125
Hempstead, L. I.	25,000	100	...	—
Jersey City	750,000	20	145	155
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch		20	30	40
New Haven, Conn.		25	152	—
Peoples, Jersey City		...	--	80
" " Bds.				95
Peoples of Albany	650,000	100	—	10
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	44	48
" Bonds			106	—
Plainfield, N. J.	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y.		50	70	80
" Citizens		100	50	60
Toledo, Ohio			95	97
Washington, D. C.	1,500,000	20	—	200
" Scrip	500,000	20	100	—
Yonkers		50	70	80
Woonsocket, R. I.	150,000	100	80	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Pittsfield, Mass.			120	130
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	72	75
Stillwater, Minn.	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
San Francisco Gas-Co., S. Fr'isco Cal.			95	95¼

64 shares Manhattan, were sold at auction at 146. The Metropolitan Gas Light Co., of New York city, have declared their regular semi-annual dividend of 5% on stock and 3½ on scrip, payable Aug. 7th. The Williamsburgh Gas-Light Company, of Brooklyn, have declared their regular quarterly dividend of 2%.

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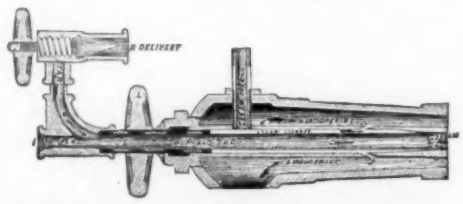

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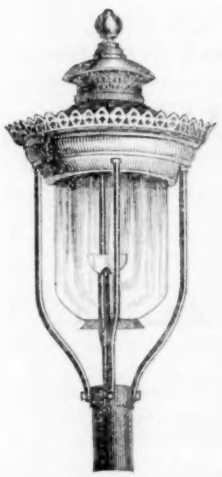

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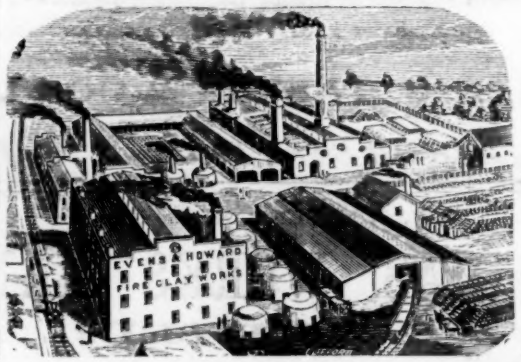

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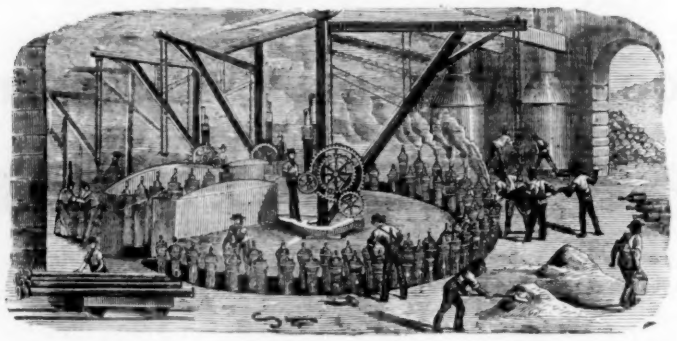

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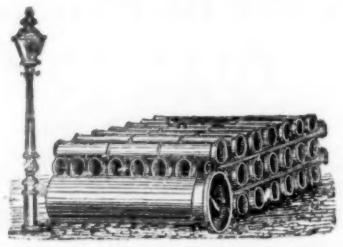

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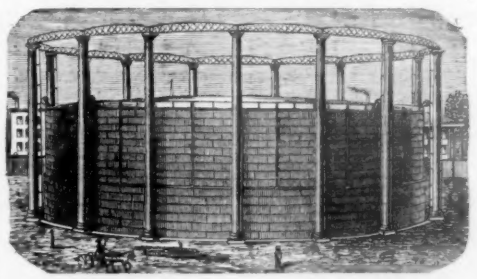

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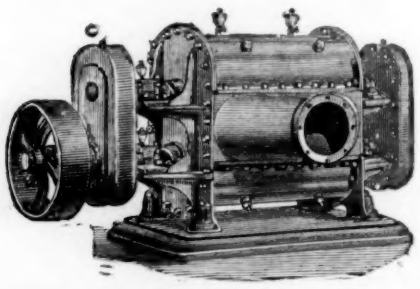

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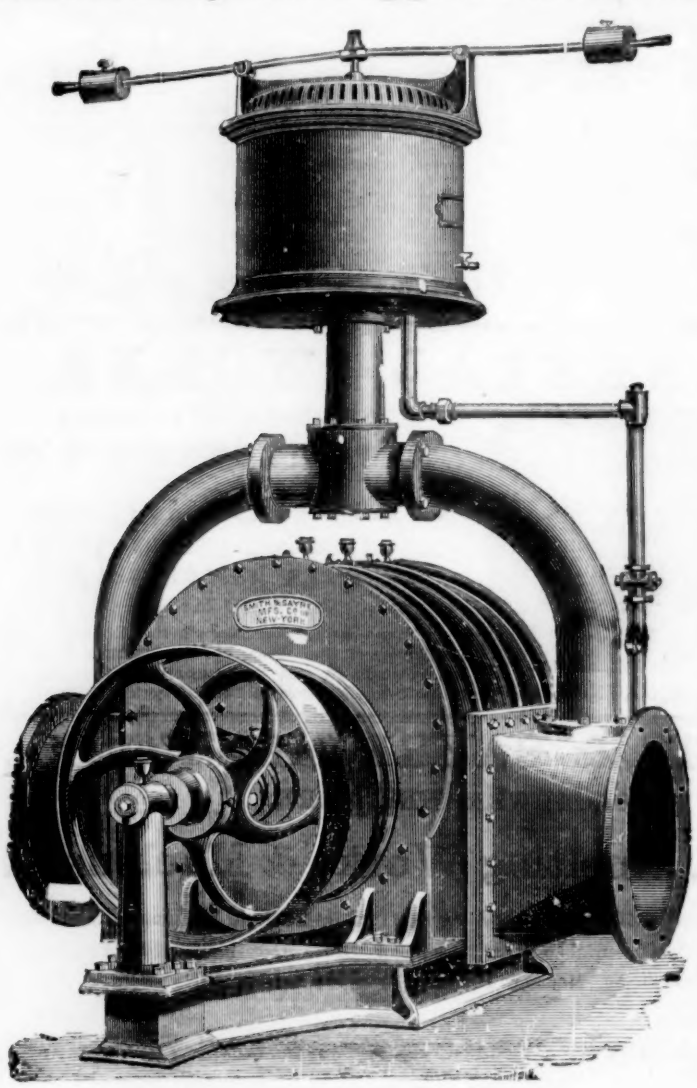

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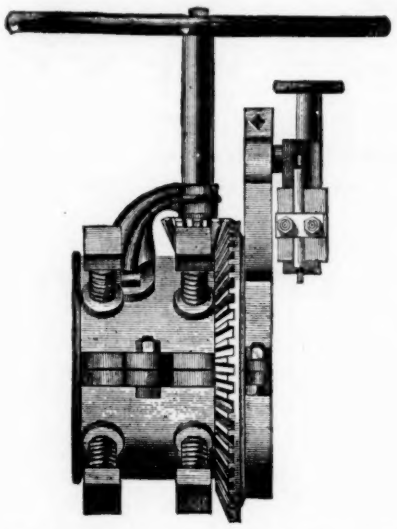

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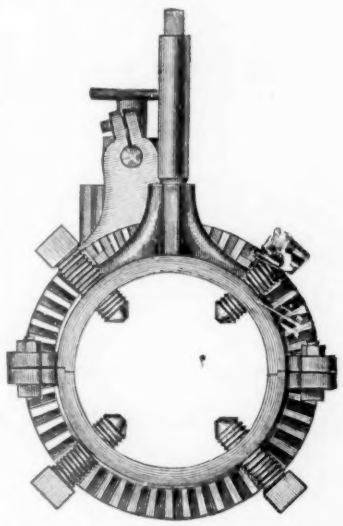

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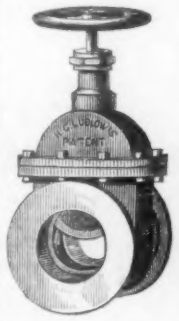

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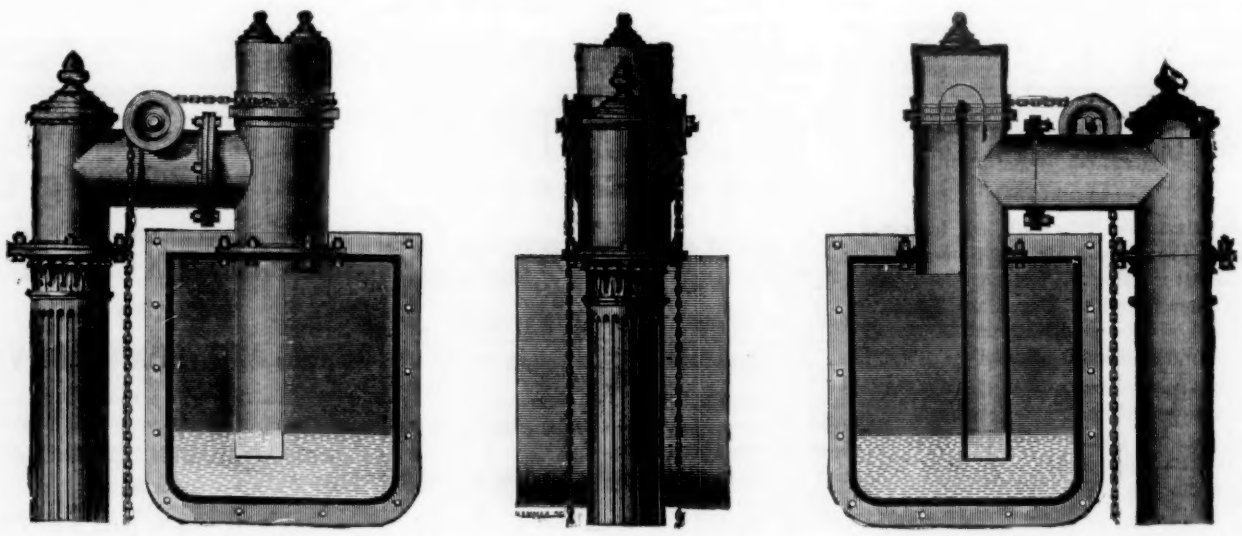

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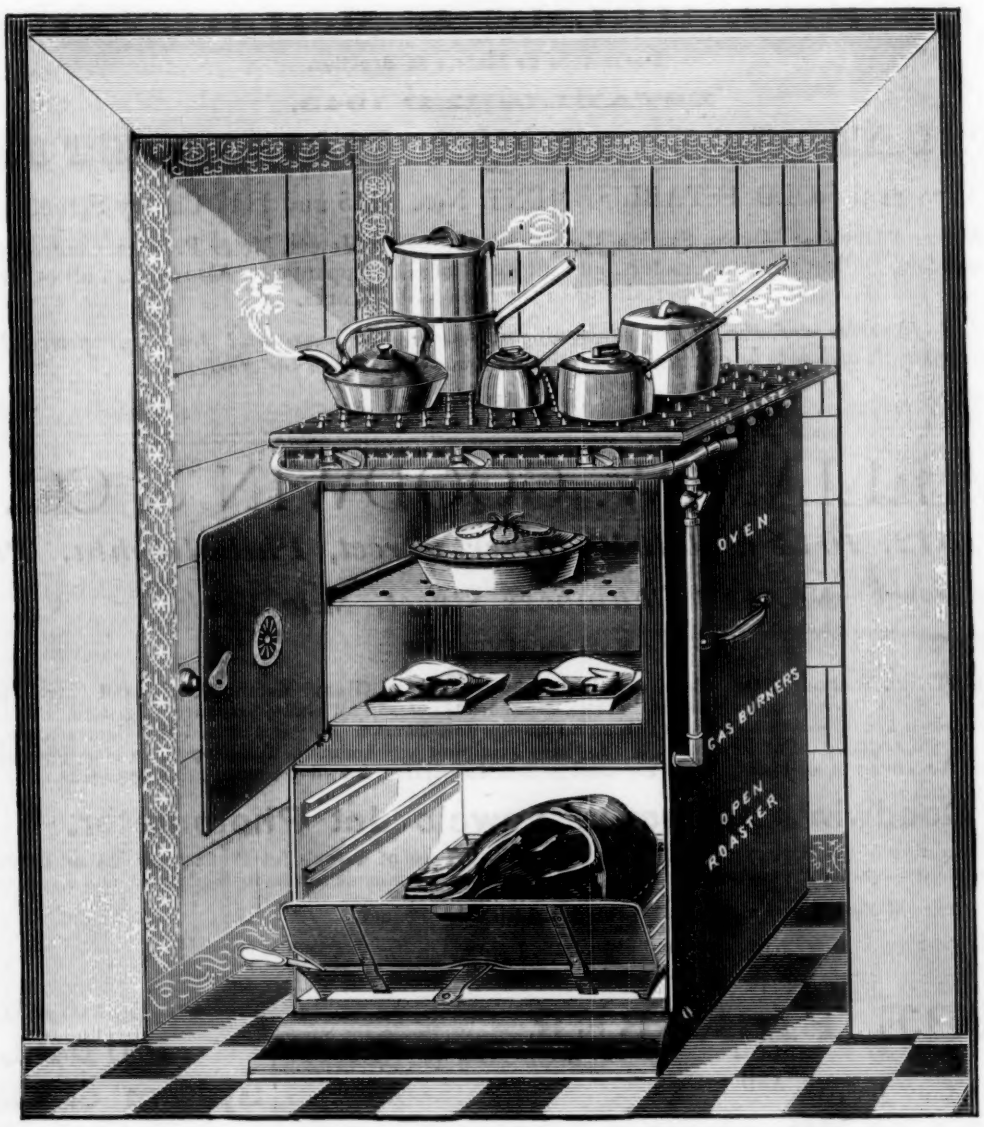

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